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Geology of the Northern Onaman Lake Area

District of Thunder Bay

by

P.C. Thurston

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CONTENTS

PAGE

Abstract ix
Introduction 1
Location and Access 1
Physiography 1
Forests, Fish and Game 2
Previous Work 2
Present Survey 2
Acknowledgments 3

General Geology 3
Early Precambrian 4
Metavolcanics and Metasediments 4
Mafic Metavolcanics 4
High-Magnesium Basalt 7
Mafic Lapillistone, Tuff-Breccia 8
Felsic Metavolcanics 9
Petrochemistry of the Metavolcanics 11
Metasediments 20
Iron Formation 20
Clastic Metasediments 21
Metamorphosed Mafic Intrusive Rocks 22
Gabbro 22
Felsic Igneous and Metamorphic Rocks 23
Migmatitic Rocks 23
Felsic Intrusive Rocks 24
Middle and Late Precambrian 26
Mafic Intrusive Rocks 26
Diabase Dikes 26
Cenozoic 29
Quaternary 29
Pleistocene and Recent 29

Structural Geology 30
Foliation, Schistosity, Cleavage and Gneissosity 30
Lineation 30
Joints 30
Major Folds 32
Minor Folds 33
Faulting 33

Economic Geology 33
Gold 34
Lead, Zinc, and Silver Replacement Bodies 34
Syngenetic Massive Sulphide Bodies 36
Iron 37
Considerations for Future Exploration 37
Property Descriptions 38
Buffalo Red Lake Mines Ltd. 38
Coulee Lead and Zinc Mines Ltd. 38
General Geology 39
Mineralized Zones 39
Vein No. 1 39
Vein No. 0 41
Vein No. 2 41
Vein No. 4 42
Vein System 5 42
Friday Vein Float 43
Vein No. 6 44
Vein No. 3 44

Canada Mines Syndicate Vein 45
Vein No. 7 45
Johnson Gold Telluride Vein 46
"Copper" Zone 46
Noranda Explor. Co. Ltd. 46
Cranston, William [1949] 48
Elite Cobalt Mines Ltd. [1967] 49
Geraboy Syndicate [1949] 49
Grey, O. [1949] 49
Headway Red Lake Gold Mines Ltd. 49
Mineral Deposits 50
Main Zone 50
A Zone 50
B Zone 52
Summary A and B Zones 52
Middleton Vein 52
Noranda Explor. Co. Ltd. 53
Hopkins, A.P. 54
Keteri Mining Company Ltd. [1962] 55
Lynx-Canada Explor. Ltd.—Dejour Mines Ltd.—Canadian Reynolds Metals Co. Ltd. . 55
McDonough, I. [1949] 60
Mesne, J. [1949] 60
Pauloski Occurrence 60
Rousandah Occurrence 61
Tashota-Nipigon Mines Ltd. 61
General Geology 62
Structure 63
Mineralized Zones 66
A Zone 66
B Zone 66
C Zone 68
D Zone 68
E Zone 68
G Zone 68
Reserves 68
Mineralogy 68
Mine Dump 70
West Showing 70
Suggestions to Prospectors 72

References 73
Index 79

TABLES

1–Table of lithologic units for the Northern Onaman Lake area 5

2–Chemical analyses of metavolcanics, Northern Onaman Lake area 12

3–Modes of granitic rocks, Northern Onaman Lake area 27

4–Affinities of massive sulphide ores associated with felsic metavolcanics 37

5–Diamond drill results by Noranda Exploration Ltd. on Coulee Lead and Zinc Mines Ltd. option 48

6–Assays on Headway Red Lake Gold Mines Ltd. "Main Zone" by Noranda Explor. Co. Ltd. 51

7–Diamond drill results by Noranda Exploration Co. Ltd. on Headway Red Lake Gold Mines Ltd. option 54

8–Drill results for No. 1 showing, Lynx-Canada Explor. Ltd. *et al.* 58

9–Drill results of Lynx No. 2 showing Lynx-Canada Explor. Ltd. *et al.* 59
10–Production at the Tashota Goldfields Ltd. mine 62
11–Assays of dump material, Tashota-Nipigon Mines Ltd. 71

FIGURES

1–Key map showing location of Northern Onaman Lake area ix
2–$FeO + Fe_2O_3$ plot for metavolcanics in the Onaman Lake vicinity 13
3–AFM diagram for metavolcanics in the Onaman Lake vicinity 14
4–MgO vs. K_2O plot for basalts in the Onaman Lake vicinity 15
5–CaO-Al_2O_3-MgO plot for basaltic rocks in the Onaman Lake vicinity 17
6–Histograms of K_2O and MgO contents of basaltic rocks in the Onaman Lake vicinity 18
7–Na_2O/K_2O vs. Al_2O_3 plot for felsic metavolcanics in the Onaman Lake vicinity 19
8–Rose diagram of joints in the Northern Onaman Lake area 31
9–Claim ownership circa 1960 in Onaman Lake area 35
10–Claim ownership, Noranda Exploration Co. Ltd. option of Headway-Coulee properties 40
11–Composite drill hole plan, Noranda Exploration Co. Ltd. option of Headway-Coulee properties ..... Chart A
12–Geology and assay plan, Coulee Lead and Zinc Mines Ltd. No. 7 Zone 47
13–Geology and assay plan, Headway Red Lake Gold Mines Ltd. "Main" Zone ..... Chart A
14–Drill hole plan, Lynx-Dejour-Reynolds No. 1 showing 57
15–Geological sketch map, Lynx-Dejour-Reynolds No. 2 showing 58
16–Tashota-Nipigon Mines Ltd., generalized surface geology 64
17–Tashota-Nipigon Mines Ltd., composite plan of underground workings and veins ..... Chart A
18–Tashota-Nipigon Mines Ltd., section of mine workings 67
19–Tashota-Nipigon Mines Ltd., geology of 625-foot level ..... Chart A

PHOTOGRAPHS

1–Mafic lapillistone 8
2–Metatexitic migmatite 24
3–Migmatized metavolcanics 25
4–Photomicrograph of polished section showing gold mineralization, Tashota-Nipigon Mines Ltd. 69
5–Same as Photo 4 at higher magnification 70
6–Same as Photo 4 at higher magnification 71

CHART

(back pocket)

Chart A—Figures 11,13,17,19.

GEOLOGICAL MAP

(back pocket)

Map 2411 (coloured)—Onaman Lake, Thunder Bay District.

Scale 1 inch to ½ mile (1:31 680).

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

If the reader wishes to convert imperial units to SI (metric) units or SI units to imperial units the following multipliers should be used:

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	**20.116 8**	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm²	0.155 0	square inches	1 square inch	**6.451 6**	cm²
1 m²	10.763 9	square feet	1 square foot	**0.092 903 04**	m²
1 km²	0.386 10	square miles	1 square mile	**2.589 988**	km²
1 ha	2.471 054	acres	1 acre	**0.404 685 6**	ha
		VOLUME			
1 cm³	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm³
1 m³	35.314 7	cubic feet	1 cubic foot	**0.028 316 85**	m³
1 m³	1.308 0	cubic yards	1 cubic yard	**0.764 555**	m³
		CAPACITY			
1 L	1.759 755	pints	1 pint	**0.568 261**	L
1 L	0.879 877	quarts	1 quart	**1.136 522**	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	**28.349 523**	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	**34.285 714 2**	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	**1.714 285 7**	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy)/ton (short)	**20.0**	pennyweights/ton (short)
1 pennyweight/ton (short)	**0.05**	ounce (troy)/ton (short)

NOTE–Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries published by The Mining Association of Canada in co-operation with the Coal Association of Canada.

ABSTRACT

The area comprising 502 km² lies about 40 km east of Lake Nipigon and 51 km north of Jellicoe off the Auden Road, a private extension of Highway 801, which runs north of Highway 11. Early Precambrian mafic and felsic metavolcanics form a narrow belt a maximum of 5.6 km wide which extends from the southwest corner of the area (Latitude 50°00′, Longitude 87°45′) northeastward for about 20 km, to the north boundary (Latitude 50°07′30″). The metavolcanics are a part of the Wabigoon Belt and consist of an extensive development of mafic flows, with a relatively minor de-

Figure 1–Key map showing location of the Northern Onaman Lake Area. Scale 1 inch to 50 miles or 1:3 168 000.

velopment of felsic pyroclastic rocks. The latter form a thin (550 m exposed width) lens exposed over a length of 8 km. Iron formation and ferruginous metasediments form three thin discontinuous units, one on the north side of the main synclinal axis and two on the south side. The belt is intruded by a small stock of metagabbro near Barn Lake. The flanking quartz monzonitic to trondhjemitic and granodioritic batholiths are probably composite in nature. The batholith on the south side of the belt is a maximum of 8 km wide and is succeeded to the south and east by an assemblage of dominantly metasedimentary migmatites. The area also contains Middle Precambrian diabase dikes.

The metavolcanic belt is isoclinally folded about steep northeast-trending, west-plunging axes, with a synclinal axis centered on the Onaman River. Shearing and small scale faulting are prevalent throughout the area.

Over the years 1934-1938 Tashota Goldfields Limited produced 12 355.8 ounces Au, 14 527 ounces Ag, and 575 430 pounds of Cu from a small, structurally controlled orebody. In 1967 the mine was dewatered, mapped, and 1220 m of underground diamond drilling was carried out. No further work has been done. Exploration interest in Pb-Zn-Ag mineralization in sheared felsic metavolcanics in the early 1950s resulted in the staking of large parts of the map-area. Headvue Mines Limited completed an electromagnetic survey, a ground magnetic survey, and 9000 m of diamond drilling on their property and a claim group optioned from the Coulee Lead and Zinc Mines Limited. Coulee Lead and Zinc Mines Limited acquired several claims north of the Headvue claims and completed about 5000 m of diamond drilling, a dip needle survey, and geological mapping in the early 1950s. These properties were optioned in 1971 to Noranda Exploration Company Limited who held the option at the time of writing.

Geology of the

Northern Onaman Lake Area

District of Thunder Bay

by

P.C. Thurston[1]

INTRODUCTION

Location and Access

The northern Onaman Lake area is bounded by Latitudes 50°00′ and 50°07′30″N and Longitudes 87°22′ and 87°45′W. The map-area lies 40 km due north of Jellicoe. Mapping was carried out at a semi-detailed scale by a five-man field party under the writer's direction in summer, 1972.

The western part of the map-area is reached by travelling 51 km north from Highway 11 on Highway 801 and the Auden road, a private road owned by Abitibi Paper Company Limited, to the Tashota mine road, and thence eastward for about 19 km. The eastern part of the area is accessible by float-equipped aircraft operating out of bases at either Jellicoe or Nakina. Note that there are no lakes accessible by road for some distance around the map-area except Frank Lake, about 19 km north of the junction of the Auden road and the Tashota mine road and Coyle Lake in south-central Elmhirst Township, about 24 km south.

Physiography

The area is relatively flat with little relief. Hills 15 to 30 m above the surrounding flat country occur in the area of Barn Lake. The lower reaches of the North Onaman River are deeply incised, with the surrounding hills 30 to 60 m above the river level. The area around Onaman Lake is quite flat and in particular the eastern and the central part of the western shore is swampy.

---

[1]Northern Archean Subsection Leader, Precambrian Geology Section, Ontario Geological Survey, Toronto. Approved for publication by the Chief Geologist, May 12, 1976. This report is published with the permission of E.G. Pye, Director, Ontario Geological Survey.

Outcrop is not abundant, with very little occurring in the muskeg surrounding Onaman Lake. The area south of Tashota mine road is low and swampy with 2 to 3 percent outcrop. The area between the road and the North Onaman River and the hilly area around Barn Lake are the only parts of the area with good exposure.

Forests, Fish and Game

The map-area lies within the central plateau section of the Boreal Forest Region. On the uplands common tree species are jackpine, black spruce, white birch and aspen. Along the river banks aspen, white spruce, balsam fir, black spruce, balsam poplar and white birch are present. Tamarack and black spruce populate the swampy areas.

Pickerel and pike are the common fish although brook trout are said to be found in the North Onaman River. Ducks of various sorts and blue herons are common on the waterways. Moose, bear, and beaver were observed during the field season.

Previous Work

E.S. Moore (1909) worked to the north in the area of Gzowski and Kowkash Townships. P.E. Hopkins (1917) mapped, in a reconnaissance fashion, an area including the map-area. He traversed the Onaman and North Onaman Rivers and the east boundary of the Nipigon Forest Reserve. No details of the present map-area were reported.

T.L. Gledhill (1925) mapped a large area which extends from Mile 45 to north of Mile 78 on the east boundary of the Nipigon Forest Reserve, and from the east end of Onaman Lake west to Humboldt Bay of Lake Nipigon, an area which includes the whole of the present map-area. He recognized for the first time the felsic pyroclastics on the 680 m portage north of MacDonald Lake (Gledhill 1925, p.74).

W.W. Moorhouse (1938) worked to the south in 1937. The present area abuts his map-area on the north.

Present Survey

The field work was done in Summer 1972, with minor follow-up work in Fall 1973. Vertical air photographs at a scale of 1 inch to ¼ mile (1:15 840) provided by the Surveys and Mapping Branch, Ontario Ministry of Natural Resources were used for mapping. Outcrops mapped in the field were plotted on acetate overlays to the air photographs and then transferred to the base maps provided by the Cartographic Section of the Surveys and Mapping Branch. The base maps are derived from Forest Resources Inventory maps, with additions and corrections by the author. Pace and compass traverses were run at approxi-

mately 400 m intervals in that part of the area underlain by the metavolcanic-metasedimentary belt, except in areas of sparse outcrop south of the Tashota mine road. In the areas underlain by granitic rocks, all strip roads were traversed and in areas with outcrop visible on the air photo, traverses were ran at about 800 m intervals. The geology is not tied to surveyed base lines or claim lines. In places it is tied to grid lines in the vicinity of the Tashota mine and the Noranda option.

Acknowledgments

The author was assisted by A.J. Andrews, B.C. Asbury, C. LaForest, and D. Baker. Mr. Andrews did independent mapping for the whole season and Mr. Asbury did independent mapping for a third of the season. R.D. Hunter did drafting, modal analyses and some petrographic work in conjunction with this report.

Personnel of Superior Airways based at Nakina, in particular J. Block provided excellent service. The late K.G. Ellard, who at that time prospected out of Nakina, provided some data on location of prospects. S.E. Amukun, R. Bucheit, C.M. Logan and R. Woolverton of Noranda Exploration Company Limited in Thunder Bay provided access to company maps, plans and drill core, which was much appreciated.

International Mine Services Limited provided data from the project of Tashota-Nipigon Mines Limited which consisted of a re-examination of the mine.

GENERAL GEOLOGY

Bedrock in the area is mainly Early Precambrian in age, by analogy with similar volcanic-granitic assemblages elsewhere in the Superior Province of the Canadian Shield (Stockwell *et al.* 1970).

The map-area lies in the central portion of the eastern end of the Wabigoon Belt (Stockwell *et al.* 1970, p.46). Viewed in a regional sense, the area lies between the felsic volcanic centre in the Elmhirst-Rickaby Townships area to the south (Wallace and Mackasey 1974) and the Oboshkegan Township centre to the north (Amukun 1977a).

Basaltic metavolcanics underlie most of the area. They form a belt extending from the Onaman River 2.5 km downstream from Onaman Lake southwestward to the area south of MacDonald Lake, a distance of 19 km at which point the belt passes out of the map-area to the south. The belt is a maximum of 5.6 km wide within the map-area.

Intercalated within the mafic metavolcanic sequence is a sequence of predominantly felsic pyroclastic rocks extending over a strike length of 7.5 km and having an exposed width of at most 440 m. These rocks lie east of MacDonald Lake and extend from east of the south end of MacDonald Lake northward for 7.5 km. Minor intercalations of quartz-feldspar porphyry and rhyolitic flows are found at scattered localities in the mafic metavolcanics.

A gabbro sill of magnesian basalt composition, about 60 m thick is intercalated with the volcanic sequence east of MacDonald Lake where it parallels the felsic metavolcanic lens over a strike length of 2 km. A stock of gabbro lies in the area between Nowlan and Barn Lakes, its extent east-west is about 2.5 km at most and it extends north of the map-area to the east of Oboshkegan Lake for well over 5 km. The body changes in character from a plug-like intrusion in the south to a more sill-like mass about 600 m thick in the north.

Oxide, sulphide and silicate facies iron formation occurs in scattered localities within the volcanic pile, but lateral continuity is difficult to establish.

The belt is bordered to the northwest and southeast by composite batholiths of quartz monzonite to trondhjemite composition, with biotite the principal mafic mineral. The north end of the belt east of Coughlan Lake is cut by a batholith of medium to coarse grained massive hornblende quartz monzonite. The area surrounding Onaman Lake is underlain by predominantly metasedimentary migmatites, with local lenses of amphibolite.

The granitic rocks are cut by northwest and north-northwest trending diabase dikes about 15 to 30 m thick.

Early Precambrian (Archean)

METAVOLCANICS AND METASEDIMENTS

Mafic Metavolcanics

The mafic metavolcanics are the most abundant rock type within the metavolcanic-metasedimentary belt. These rocks extend the full length of the map-area, striking in a northeasterly direction. Intercalated with them are thin units of intermediate pyroclastics, graphitic schist and slaty metasediments. The mafic metavolcanics are cut by sills of lamprophyre, quartz-feldspar porphyry, and gabbro, and appear to be the oldest rocks in the belt.

The mafic metavolcanics are basaltic in composition. Little or no quartz was noted in thin section, the rocks are commonly pillowed, and chemical analyses of rocks in the map-area (see "Petrochemistry of the Metavolcanics") and in the area to the north (Amukun 1977a, 1977b) indicate that the mafic metavolcanics are tholeiitic basalts.

Outcrop is sparse, however the available data suggests that the sequence consists of a succession of pillowed flows (less than 150 m thick in most cases) with massive zones occurring at the centers of the flows.

The basalts are massive to strongly foliated with a grain size generally of 0.1-2.0 mm but approaching 4-5 mm in the coarse flow centres. These metamorphosed basalts consist of about equal proportions of feldspar and hornblende. These rocks are relatively massive and equigranular but in outcrops of about 3 m by 15 m changes in grain size are often apparent.

The pillowed upper portions of flows were mapped in several localities, such as west of the Tashota mine on claim 522. Massive mafic flows can be traced

TABLE 1 | TABLE OF LITHOLOGIC UNITS FOR THE NOTHERN ONAMAN LAKE AREA.

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Till, clay, sand, and gravel.

PRECAMBRIAN

MIDDLE AND LATE PRECAMBRIAN (PROTEROZOIC)

MAFIC INTRUSIVE ROCKS

Feldspar-phyric diabase, massive diabase.

Intrusive Contact

EARLY PRECAMBRIAN (ARCHEAN)

FELSIC IGNEOUS AND METAMORPHIC ROCKS

FELSIC INTRUSIVE ROCKS

Biotite, biotite-hornblende trondhjemite, granodiorite; hornblende, hornblende-biotite quartz monzonite; biotite, biotite-hornblende quartz monzonite; pegmatite, aplite, quartz-feldspar porphyry.

Intrusive or Gradational Contact

MIGMATITIC ROCKS

Metasedimentary migmatite, >10% granitic material; metavolcanic migmatite.

METAMORPHOSED MAFIC INTRUSIVE ROCKS

Gabbro, diorite.

Intrusive Contact

METAVOLCANICS AND METASEDIMENTS

METASEDIMENTS

Conglomerate, graphitic schist, slaty metasediments.

FELSIC METAVOLCANICS

Rhyolite, rhyodacite, crystal and lapilli tuff, banded tuff, rhyolitic quartz-feldspar porphyry, intermediate pyroclastic rocks

MAFIC METAVOLCANICS

Massive to foliated flows, pillowed flows, porphyritic flows, chlorite schist, tuff, amygdular flows, lapillistone, tuff-breccia, high magnesian basalt.

over 15-30 m perpendicular to strike into a gradational contact with thin (0.6-3 m) pillowed units. Conversely, some flows, particularly between Nowlan Lake and the Onaman River, seem to consist of upwards of 30 m of pillowed basalt.

Pillows are generally relatively small, and vary from unstretched bun and balloon shaped masses (30-60 cm on average) to stretched lenticular bodies 1 m by 30 cm. About 1 km west of MacDonald Lake the pillows are commonly zoned with a white weathering core about 10 cm by 10 cm surrounded by progressively darker green shells averaging 2.5 cm thick, ending with a dark green chloritic selvage up to 2.5 cm thick. The pillows here, where undeformed are up to 60 cm by 30 cm, however, they are commonly intensely sheared, and the

light-weathering pillow centers give the appearance of coarse agglomerate.

In the area about 1 km northeast of the Tashota mine, the pillows display concentrations of amygdules toward the rims, and a more massive dark weathering centre. Pillow rims in the immediate vicinity of the Tashota mine are commonly rusty and contain a trace of disseminated pyrite.

Inter-pillow sediment is common throughout the area. West of MacDonald Lake cherty masses up to 3 by 15 cm are found between pillows. Much smaller masses of rusty weathering pyritic chert are found between pillows in the Tashota mine area. Biotitic metasediments are found in 1 by 3 cm masses between pillows 0.8 km south of Nowlan Lake. Porphyritic basalt is common in massive and pillowed parts of the sequence. The phenocrysts are commonly chalky white and soft on the weathered surface, and are composed of epidote pseudomorphic after feldspar. Chlorite schist occurs in association with shear zones in the mafic metavolcanics.

In thin section the basalts occasionally display a relict subophitic texture in the coarser grained varieties, where grain size reaches 2-3 mm or more. More commonly the rocks display a fine grained (0.1-0.15 mm) habit with the following mineralogy: heavily saussuritized albitic plagioclase, actinolite, magnetite, minor chlorite, epidote, sericite, carbonate, and sphene.

Mafic metavolcanics close to the contact with the granitic batholiths commonly display a hornfelsic texture in thin section. Hornblende is the common mafic mineral and it is usually poikiloblastic with inclusions of quartz, feldspar, and opaque iron oxides. Poikiloblastic biotite with inclusions of quartz and feldspar is a minor constituent. The feldspar is untwinned and consists of ragged grains less than 0.2 mm which have higher relief than the surrounding quartz and appears to be in the andesine range.

In general the metavolcanics toward the center of the belt display assemblages consisting of saussuritized albitic plagioclase ($An_{<10}$) actinolitic amphibole, chlorite, and white mica (trace). Toward the granitic contact, hornblende and plagioclase in the range An_{20-25} are the dominant minerals, with trace amounts of opaque iron oxides, sphene, carbonate, and epidote. Garnet is present in a number of outcrops within 300 m of the granite contact south of Pauloski Lake.

Epidote pods and streaks are found at numerous localities south of Pauloski Lake and at Latitude 50°01′, Longitude 87°43′ in the mafic metavolcanics. They appear in outcrop to be 1-5 cm thick and to extend laterally for up to 10 m. Their restriction to the outer margins of the belt would suggest that they are also a contact metamorphic effect (Pyke 1973, p.5).

Chlorite schist occurs only to a minor extent in the area in association with shear zones. In outcrop it weathers dark green and dark blue-green. Occurrences consist of small outcrops, usually not traceable any appreciable distance. This rock type was not examined in thin section. Typical occurrences are found about 3.6 km east of Pauloski Lake on claims 2191 and 2193.

Mafic tuff occurs in a few scattered localities throughout the map-area. The first occurrence is about 1070 m north of the Onaman River and 1680 m west of MacDonald Lake. Exposed width and length are on the order of tens of metres or so and the band is not traceable along strike. The weathered surface is dark green with scattered, white-weathering irregularly shaped relatively feldspathic lapilli. In thin section, the rock is seen to consist of angular to stream-

lined lapilli up to 10 by 2-3 mm which consist of anhedral granular textured masses of quartz (<10 percent), albitic feldspar and amphibole (20 percent) with minor opaque iron oxides and carbonate, and about an equal amount of lapilli replaced almost entirely by carbonate, in a matrix composed of radiating sheafs and masses of poikiloblastic hornblende with abundant opaque iron oxide inclusions and interstitial albitic saussuritized plagioclase.

Another occurrence lies 2.9 km WNW of the Tasheta mine and about 60 m east of the Onaman River. The weathered surface is grey and the fresh surface a mottled chloritic green. The rock is strongly foliated, carbonatized and sheared. However, thin section examination discloses a very fine grained (0.02 mm) rock consisting of streamlined, elliptical lapilli with a slightly larger grain size (4.0 mm). The lapilli have a colour index of 10-30 and are set in a matrix with a colour index of 30-40 consisting of actinolite, chlorite, and saussuritized plagioclase. The rock appears bedded based on variation in accessory opaque iron oxide content and clast size and distribution. It is, however, possible that this occurrence is a sheared intermediate to mafic metavolcanic flow. In general this rock type is not extensive, but appears to be associated with the mafic volcanic sequence.

HIGH MAGNESIAN BASALT

Based upon a small number of chemical analyses the author now considers that the unit described originally as 'recrystallized mafic metavolcanics' (Thurston 1973) is, at least in part, high magnesian basalt. These rocks consist of 2-3 mm composite grains of hornblende set in a matrix of saussuritized feldspar. They differ from the metagabbro in being slightly finer grained and more altered and in being closely associated with massive, pillowed and porphyritic mafic metavolcanics. The metagabbro sill east of MacDonald Lake, while closely associated spatially with the metavolcanics, is discordant to the stratigraphy, very much coarser grained, and displays some tendency toward a chilled margin against the metavolcanics, whereas the high magnesian basalts are concordant, gradational into pillowed units, and only slightly coarser than the other mafic flows. The high magnesian basalt is interpreted as representing coarser grained central portions of flows. In outcrop the high magnesian basalts have a brown to dark green weathered surface with higher weathering coarse (2-3 mm) aggregates of hornblende. In thin section the hornblende aggregates consist of polycrystalline aggregates of hornblende with abundant opaque iron oxide inclusions and minor actinolite and chlorite. The aggregates range up to 2 mm by 3-5 mm in size and exhibit an ophitic texture with saussuritized albitic plagioclase filling the interstices. The plagioclase and mafic minerals are present in about equal amounts. Chemically this rock is a high magnesian basalt (see Table 2, number 3) and is further discussed in the section on petrochemistry.

In the map-area this unit can be distinguished from coarse-grained centres of mafic flows of tholeiitic chemistry by virtue of the coarse grain size of the amphibole aggregates. The coarse flow centres of the other mafic flows consist of relatively coarse plagioclase and mafic minerals.

Photo 1–Mafic lapillistone, slightly sheared, enclosed by mafic flows. A small rubble zone at the eraser end of the pencil would indicate a short pause in volcanism. The fragments are slightly lighter than the matrix. The outcrop lies west of MacDonald Lake.

The magnesian basalts occur as individual flows or groups of flows up to 90 m thick extending over strike lengths of a thousand metres or so. They do not seem to occupy a particular stratigraphic position.

MAFIC LAPILLISTONE, TUFF-BRECCIA

Mafic lapillistone (Photo 1) and tuff-breccia occur intercalated with the mafic metavolcanics. In areas where the lapillistone was observed overlying mafic flows, such as 2.4 km west-northwest of the lake on the Onaman River the upper portion of the flows are pillowed and the pyroclastics immediately overlie the flows without the development of weathered zones or cherty marker horizons. It is difficult, given the poor outcrop exposure throughout the area, to trace the beds of pyroclastics laterally with any certainty. The author has interpreted however, that a band of tuff-breccia about 45-75 m thick extends from the north end of Pauloski Lake northeastward about 2 km to the Pauloski shear where it is offset right laterally about 200 m from whence it continues to the Onaman River where it is again offset left laterally about 150 m. The band persists from the river eastward about 5 km, where it is cut off by granitic rocks. A second band of about the same thickness lies about 600 m south of the

first and persists from the Pauleski Lake area through to a point just east of the Onaman River with similar offsets.

Two bands to the south are believed to be the same units repeated by folding. However lack of outcrop precludes extending them from the MacDonald Lake area to where they next outcrop east of the Onaman River.

The pyroclastic rocks typically consists of 20-60 percent clasts up to 2 cm by 8 cm of lighter weathering material in a basaltic matrix (see 1-6a-1a or 1-13-6 in Table 2). The clasts are not well rounded and assume bomb-like shapes. The units grade laterally into the mafic tuff described earlier. The units can be distinguished from the flows and pyroclastics east of MacDonald Lake because the latter are more siliceous.

According to the clast size classification of Fisher (1966) the rocks in this unit range from tuff-breccia to lapilli-tuff, with only occasional bombs greater than 64 mm present.

Felsic Metavolcanics

The main occurrence of felsic metavolcanics in the map-area extends about 6 km from near the south boundary of the area to a point about 1.5 km east of the Onaman River. The unit is a maximum of 500 m wide and narrows conspicuously at either end. Rock types represented within the unit are: minor, mafic crystal tuff; intermediate lithic lapilli-tuff; felsic lapilli-tuff; felsic tuff; chloritoid-sericite schist; rhyolite quartz porphyry; and minor amounts of flow banded rhyolite. The pyroclastic rocks are much more abundant than the flows.

Crystal lapilli-tuff is the most extensive rock type within the unit. In the southern part of the unit exposures of felsic crystal tuff are finely bedded (beds 3-10 mm thick). The coarser fragments are more resistant to weathering than the finer matrix, and stand out on an irregular weathered surface, which is white, cream-yellow or grey. Individual beds can often be followed the length of an outcrop (15 to 20 m). Primary structures in these beds are rare, but graded bedding from fine-ash size matrix up to 2-4 mm lapilli-sized particles, is found occasionally. The sense of grading is constant throughout individual outcrops, seems to involve only fine matrix and fine lapilli-size particles and is not subject to local reversals. The degree of sorting and fineness of the bedding would seem to indicate an appreciable distance from the eruptive center (MacDonald 1972, p.135; Walker 1967).

In thin section, mineral assemblages consist of quartz, oligoclase, actinolite, sericite, and traces of opaque iron oxides and biotite. The matrix is a fine grained mass of anhedral quartz and plagioclase grains forming a granular texture (grain size <0.5 mm) with very small sericite grains occasionally present in the feldspar grains. Twenty to forty percent of the volume of the rock is taken up with lapilli-size crystal and lithic fragments. The crystalline fragments are subhedral to anhedral with a certain amount of embayment along the edges and the average size is 3-4 mm. They consist of strained single grains of quartz and individual feldspar crystals with minor sericite inclusions. The lithic fragments are polycrystalline aggregates with a slightly higher colour index than the matrix and consist of feldspar crystal fragments and a finer

groundmass of quartz, feldspar and sericite. Bedding is defined by minor size differences in the material forming the matrix and by concentrations of clasts in particular beds. The rocks are interpreted as lithic and crystal tuffs but the extent, if any, of re-working is unknown. The regularity of the graded bedding and absence of reverse grading, suggest that a turbidite mode of deposition is a distinct possibility.

Felsic tuff consists in outcrop of very fine grained to aphanitic material with a grey to white weathered surface and a slightly irregular weathered surface with occasional lapilli weathering in relief, and a general appearance of being finely bedded. A subconchoidal fracture is usually found. The outcrops of this rock type are scattered over the length of the main felsic unit and, at least at the south end, appear to be closely associated with the chloritoid-sericite schist. In thin section, bedding, where present is defined by minor changes in grain size and changes in abundance of opaque iron oxides. The rock consists of a fine-grained schistose aggregate of quartz, albitic plagioclase, sericite, epidote needles and occasional traces of biotite associated with larger clumps of sericite and opaque iron oxides. There are occasional grains of feldspar, which occur as clasts somewhat larger than the matrix (size 4 mm).

The rock type cannot be consistently traced within the main unit of felsic metavolcanics and seems to occur in rather thin bands.

Chloritoid-sericite schist occurs in scattered locations in the main lens of felsic metavolcanics and is extremely fissile with subsidiary jointing breaking the rock into small (down to 10 mm square) parallelograms. The weathered surface is commonly ribbed by resistant quartz-filled joints striking at an angle of up to 20 degrees to the bedding in the associated felsic pyroclastics.

The preliminary maps (Thurston 1973) indicated this unit to be amphibole-sericite schist but microscopic examination indicated an assemblage consisting of chloritoid, chlorite, quartz, albite, sericite, epidote and minor opaque iron oxides. The quartz and feldspar form a fine-grained groundmass (grain size <0.05 mm) which also contains finer grained anhedral chlorite (var. penninite?) with anomalous blue interference colours. Radiating rosettes of chloritoid displaying an acicular habit, constitute 15 percent of the rock and are the phase previously tentatively identified as "amphibole".

The rock appears to be a felsic metavolcanic; no bedding or fragments were observed, and the rocks are most probably of felsic flow origin.

Crystal lithic tuff, occurs in a wedge shaped mass 900 m along strike by a maximum of 500 m in width which lies about 1200 m west of the Tashota mine, centered approximately on the main road. It is interbedded with a thin unit of amphibolitic mafic metavolcanics. The outcrop surface weathers grey to brown and breaks with a hackly fracture, exposing a fresh surface which is grey and aphanitic with 20-30 percent 3 mm opalescent quartz eyes and occasional feldspar clasts of roughly the same size.

In thin section the rock consists of oligoclase to andesine with inclusions of potassic feldspar, quartz, sericite, biotite, iron oxides, apatite and clinozoisite. The quartz occurs as fine grains in the groundmass (average grain size 0.05 mm) and as large strained and polycrystalline clasts up to 3 mm maximum length. Feldspar occurs in the groundmass and as small crystal clasts which are much less abundant (<10 percent of the phenocrysts). Sericite occurs as fine grains in the matrix and replaces plagioclase phenocrysts. It occurs as very fine

grains, forming wispy foliated aggregates in the matrix.

The unit is interpreted as felsic crystal and lithic tuff metamorphosed to slightly higher rank than the MacDonald Lake—Onaman River felsic unit on the basis of the plagioclase composition, the occasional presence of biotite, the subhedral grains of piedmontite, the clastic texture, and the presence although much modified of relict lapilli-sized lithic and crystal fragments.

Rhyolite and rhyodacite occur as thin units with uncertain lateral extent. Maximum thickness is about 70 m and units occur over a distance of about 5 km in the main felsic metavolcanic unit. The weathered surface is chalky white and the colour is grey and the rock aphanitic on the fresh surface. The unit is well foliated and commonly has sericitic partings. In thin section albitic plagioclase and quartz (≥90 percent) and minor epidote, form a fine grained, granular and schistose matrix. About 10 percent of the rock is composed of porphyroblastic aggregates 1 mm by 2-3 mm composed of contorted white mica flakes and occasional traces of apatite and opaque iron oxides. Fine needles of sericite are also present in the groundmass. The rock is designated a rhyolite on the basis of the relict flow banding emphasized by the sericitic partings, and the colour index.

Dacitic metavolcanics described in Preliminary Map P.846 (Thurston 1973) are largely rhyodacitic in composition.

The metamorphic mineral assemblages observed in the felsic metavolcanics are listed below and indicate metamorphism under greenschist facies conditions (Zen 1960; Ayres 1971, Table 5).

1) Quartz ± albite ± chloritoid ± chlorite ± muscovite ± epidote.
2) Quartz ± albite ± chlorite ± carbonate ± white mica ± epidote.
3) Quartz ± albite ± biotite ± muscovite ± epidote ± chlorite.

The presence of the chloritoid and chlorite suggests that some of these felsic metavolcanics are relatively iron-rich and more femic than the others and probably correspond to rhyodacitic or dacitic flows.

Petrochemistry of the Metavolcanics

A suite of 10 metavolcanic rocks from this map-area (Table 2) plus a total of 50 rocks, mostly metavolcanics from the map-area to the north (Amukun 1977a) have been analyzed by the Geoscience Laboratories, Ontario Geological Survey. As the two map-areas lie along strike from one another all these analyses have been considered together so that a more substantive interpretation can be presented.

A plot of $FeO + Fe_2O_3$ vs. SiO_2 (Figure 2) discloses that that rocks of the present map-area and those on strike to the north (Amukun 1977a) consist of basalt and dacite through rhyolite, but few andesites are represented. This so-called "andesite gap" or "Daly gap" (Daly 1925) is a well known phenomenon. Yoder (1973) described several examples of close juxtaposition of the contrasting rock types and examples of simultaneous eruption of both basalt and rhyolite. Viljoen and Viljoen (1969b) in the Barberton Mountain Land describe a

TABLE 2 | CHEMICAL ANALYSES OF METAVOLCANICS FROM THE NORTHERN ONAMAN LAKE AREA.

Sample No.	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	H_2O+	H_2O-	CO_2	TiO_2	P_2O_5	S	MnO	Total	LOI+
1) 1-32-5	64.8	16.1	0.53	2.11	1.92	3.86	5.75	0.34	1.54	0.08	0.13	0.59	0.17	0.02	0.05	100.0	
2) 1-13-6	46.6	15.0	0.16	10.2	3.89	9.78	2.20	0.34	3.56	0.57	6.35	0.95	0.06	0.01	0.39	100.1	
3) 1-0-7	45.1	15.1	0.34	9.50	10.8	5.01	2.35	0.17	5.71	0.47	2.72	0.94	0.05	0.01	0.19	99.4	
4) 1-6a-1a	53.9	15.5	0.00	13.4	6.76	5.66	1.89	0.05	1.01	0.31	0.23	1.19	0.09	0.04	0.35	100.4	
5) 1-4-1	52.7	15.3	0.22	10.6	5.28	7.20	2.59	0.17	2.45	0.49	0.71	1.44	0.10	0.03	0.22	99.5	
6) 1-17-3	47.6	16.0	0.88	11.0	8.03	8.65	2.16	0.07	2.14	0.36	0.19	1.36	0.08	0.05	0.21	98.8	
7) 1-17-5	49.4	16.3	1.56	8.85	7.68	8.62	2.62	0.02	2.28	0.49	0.16	0.96	0.07	0.03	0.21	99.3	
8) 3-2-5	52.2	14.3	1.20	9.90	6.27	8.31	2.89	0.53	2.02	0.41	0.12	0.92	0.14	0.01	0.19	99.4	
9) stop 8	64.8	16.9	0.59	2.28	6.30	0.35	0.24	4.51	2.58	0.41	0.16	0.29	0.11	0.01	0.05	99.6	
10) 1-10-11	74.9	15.3	0.66	0.49	0.48	0.56	2.81	3.81	0.66	0.40	0.20	0.23	0.03	0.01	0.03	99.9	
11) Ann 9	78.44	15.52	0.41	0.68	0.38	0.29	0.49	2.33	1.31	0.21	-	0.54	0.14		0.01		
12) Ann 10	70.50	14.50	0.49	1.33	1.28	1.68	6.29	1.24	0.99	0.09	1.45	0.26	0.11		0.04		
13) Ann 15	63.23	15.33	1.91	2.42	2.41	3.08	4.58	4.48	0.93	0.18	0.99	0.45	-		0.08		
14) Ann 14	57.68	19.20	0.90	1.72	1.29	3.98	5.03	3.50	2.36	0.32	1.73	2.57	0.31		0.08		
15) Arndt 9	52.3	13.6		11.4*	9.3	10.5	1.8	0.19				0.73			0.02		3.1
16) Arndt 8	53.0	14.4		10.9*	7.76	11.5	1.83	0.03				0.83			0.18		3.5

1) Quartz-feldspar porphyry dike, N. Onaman Lake area; Lat. 50.0772°, Long. 87.8625°.
2) Mafic pyroclastic breccia, N. Onaman Lake area; Lat. 50.0992°, Long. 87.6214°.
3) Magnesian basalt, N. Onaman Lake area; Lat. 50.0488°, Long. 87.6343°.
4) Magnesian basalt, N. Onaman Lake area; Lat. 50.0481°, Long. 87.6522°.
5) Magnesian basalt, N. Onaman Lake area; Lat. 50.0555°, Long. 87.6269°.
6) Magnesian basalt, N. Onaman Lake area; Lat. 50.0206°, Long. 87.6776°.
7) Magnesian basalt, N. Onaman Lake area; Lat. 50.0084°, Long. 87.6736°.
8) Gabbro stock, N. Onaman Lake area; Lat. 50.1133°, Long. 87.5569°.
9) Altered felsic metavolcanic, N. Onaman Lake area; Lat. 50.0333°, Long. 87.6188°.
10) Quartz feldspar porphyry dike, N. Onaman Lake area; Lat. 50.0900°, Long. 87.6014°.
11) Annhaeuser (1973) siliceous aluminous schist (altered tuffaceous sediment).
12) Annhaeuser (1973) feldspar porphyry intrusive into Komatiite formation.
13) Annhaeuser (1973) porphyry intrusive into Hoogenoog formation.
14) Annhaeuser (1973) pillowed acid lava, Kromberg formation.
15) Arndt (1974) average of seven magnesian basalts.
16) Arndt (1974) magnesian basalt, massive flow.

\+ Calculated anhydrous
* Total iron as FeO

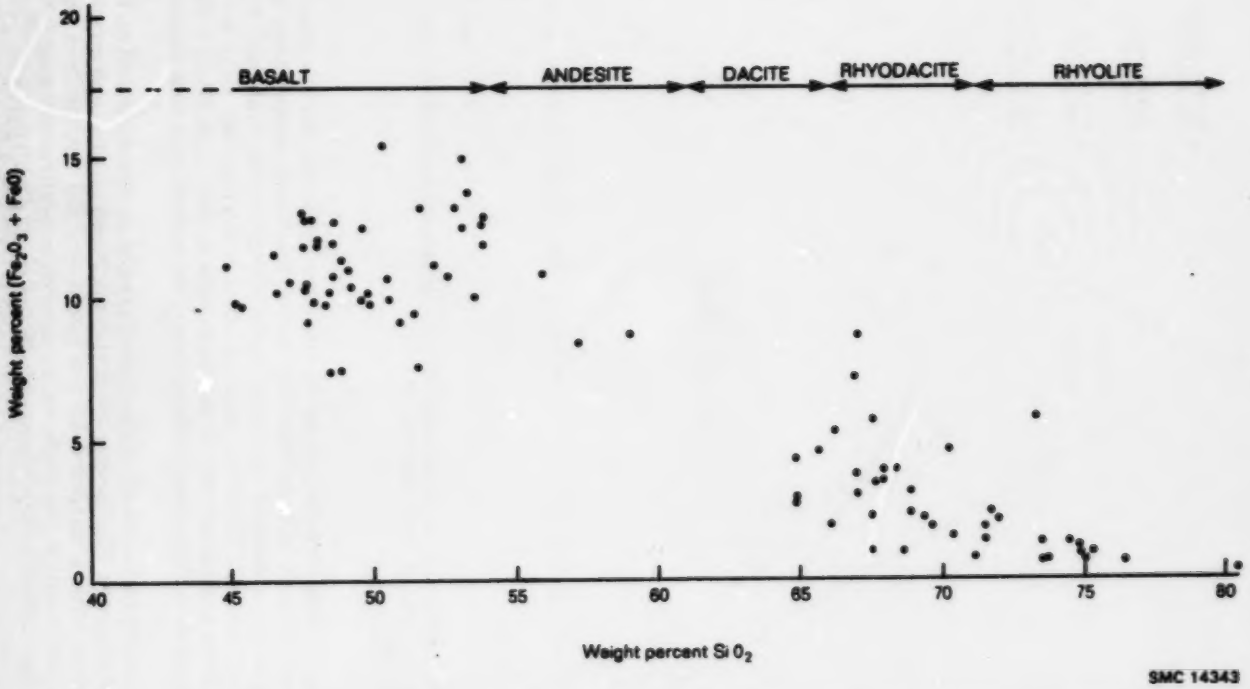

Figure 2–Plot of ($FeO + Fe_2O_3$) vs. SiO_2 (after Descarreaux 1972) for metavolcanics in the Onaman Lake vicinity. Data from: northern Onaman Lake map-area, 10 samples (Thurston, this report); Gledhill Lake map-area, 50 samples (Amukun 1977b); Tashota map-area, 10 complete and 19 partial analyses (Amukun 1977a).

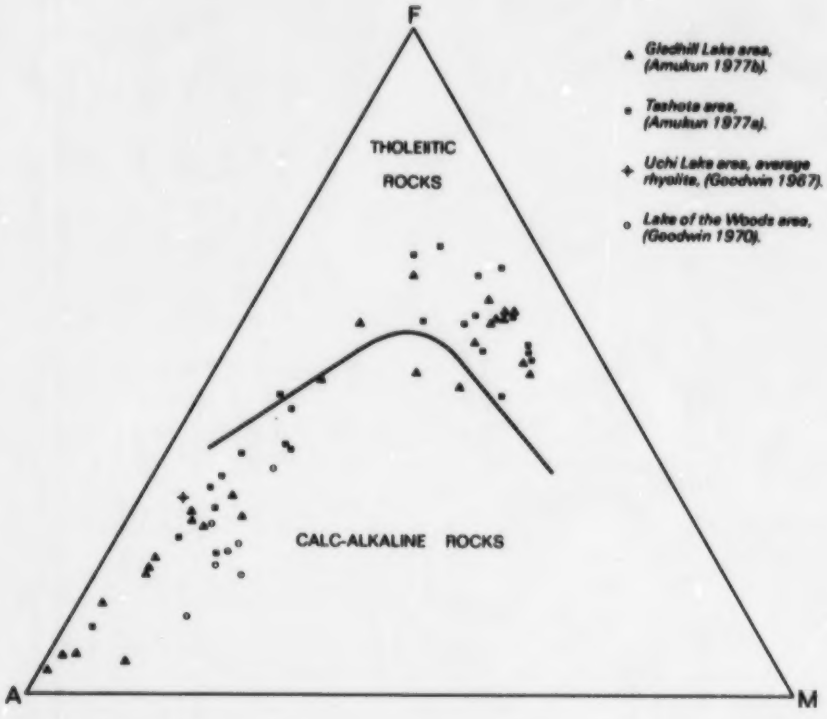

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Figure 3–AFM diagram (after Irvine and Baragar 1971) for metavolcanics in the Onaman Lake vicinity. A = $Na_2O + K_2O$; F = $FeO + 0.9\ Fe_2O_3$; M = MgO.

similar gap in rock compositions in the Onverwacht Group, the lowermost unit in that metavolcanic belt. As described below, the basalt compositions resemble the upper formations of the Onverwacht Group in their high MgO content and low K_2O content. The felsic metavolcanics of the Onaman Lake area also resemble those associated with tholeiitic basalts in their high Na_2O and Al_2O_3 content relative to those felsic volcanic rocks associated with calc-alkaline basalts.

The basaltic rocks are all of the tholeiitic suite as demonstrated on Figure 3, an AFM diagram. The basalts are divided between olivine- and quartz-normative types, with a tendency for the coarse-grained flow centres (in part shown as gabbro sills in the mafic metavolcanics on preliminary map P.846) to have a higher content of MgO (generally in the range 8.8-10 percent). The finer grained and pillowed varieties of basalts have MgO contents in the range 8.2 to just below 4.0 percent. Figure 4 shows the generally high magnesium composi-

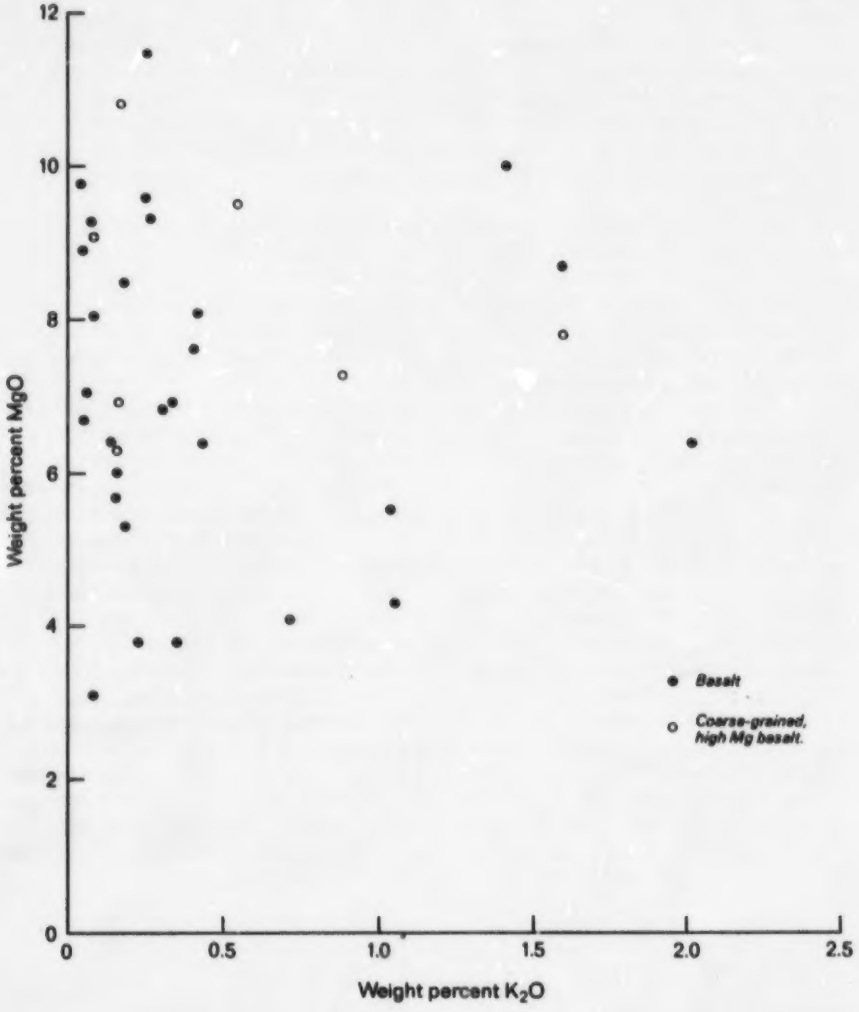

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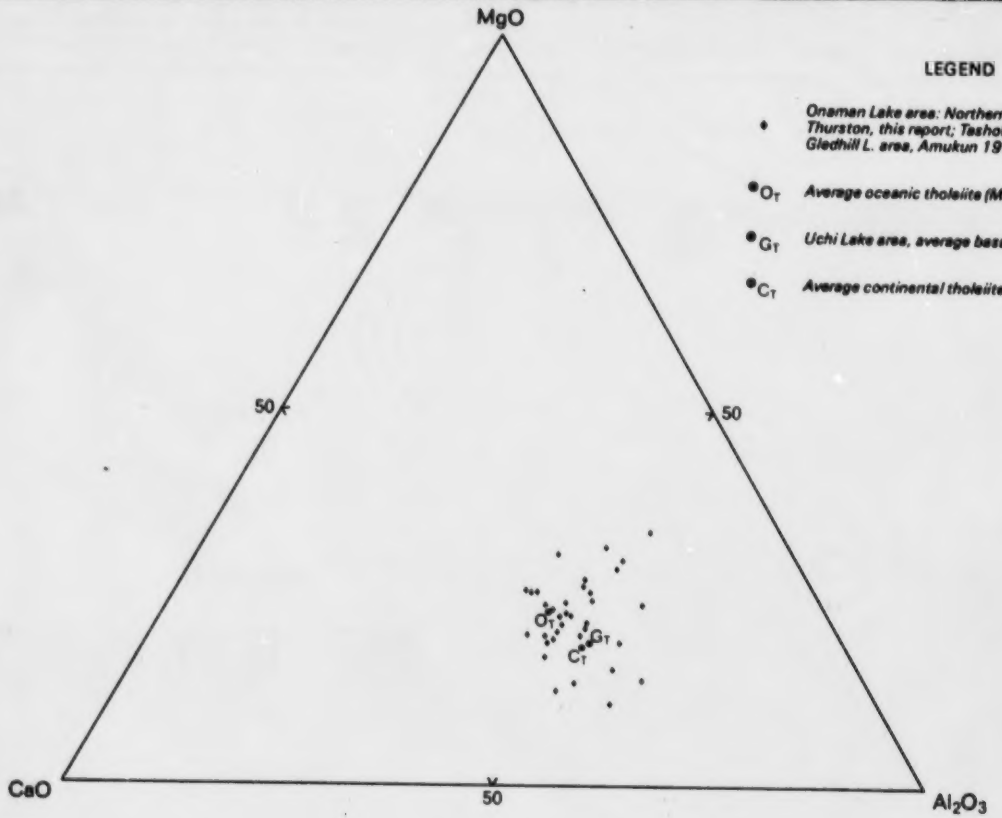
Figure 4–Plot of MgO vs. K_2O for basalts from the Onaman Lake vicinity. Data from: northern Onaman Lake map-area, 5 samples (Thurston, this report); Tashota map-area, 5 samples (Amukun 1977a); Gledhill Lake map-area, 25 samples (Amukun 1977b).

tion of the coarse-grained basalts containing amphibole-rich metacryst aggregates. These magnesian-rich basalt compositions plot on Figure 5 in the area shown in a similar figure by Viljoen and Viljoen (1969b, p.143) for Mg-rich basalt of the Hoogenoeg and Kromberg Formations in the upper part of the Onverwacht Group of the Barberton Mountain Land. The less magnesian basalts of the Onaman Lake area fall in the same general area of Figure 5 as the average continental tholeiite (Manson 1968) and oceanic tholeiites of Engel *et al.* (1965). On the ternary diagram CaO, Al_2O_3, and MgO (Figure 5), the finer grained massive and pillowed tholeiitic basalts plot in the general area of Goodwin's average basalt for the Uchi Lake area (1967) and the average oceanic tholeiite of Manson (1968). The coarser grained basaltic rocks with higher MgO contents mentioned above have a tendency to have higher CaO/Al_2O_3 ratios and plot closer to the field of the basaltic komatiites of Viljoen and Viljoen (1969b, p.143).

The high MgO basalts which plot above MgO = 20 percent (normalized) on the $CaO\text{-}Al_2O_3\text{-}MgO$ ternary diagram (Figure 5) appear to fall in the series defined by Arndt (1976, p.19) as the "magnesian" series. The "magnesian" series is distinguished from the tholeiites on the basis of higher MgO/FeO ratios, and TiO_2 content generally below 0.8 percent whereas most tholeiites have a TiO_2 content greater than 0.9 percent in the Munro Township area where the magnesian series has been defined by Arndt.

A histogram of K_2O content (Figure 6) suggests that two populations of basaltic rocks exist in the map-area, a group with a K_2O content below 0.20 percent and a second group with K_2O content ranging from 0.3 to 0.6 percent. The lower K_2O group, also is marked by a low Fe_2O_3/FeO ratio, high Na/K and low TiO_2, all characteristics ascribed by Engel *et al.* (1965) to oceanic tholeiites and by Arndt (1976) to his "magnesian" series. The higher potash group are similar to Goodwin's (1967, 1970b) average Canadian Shield basalts. Viljoen and Viljoen (1969b, p.146) have related similar rocks to continental tholeiites and to a higher level in the volcanic pile than the first group. However, given the lack of stratigraphic control and the relatively high metamorphic rank of the Onaman Lake rocks, this correlation can only be very tentatively suggested. The high MgO basalts represent rocks from the Onaman Lake area which belong to Arndt's (1976) "Magnesian Series" with a lower limit of 8 percent MgO, approximately although the series is best defined in terms of a $CaO\text{-}Al_2O_3\text{-}MgO$ plot.

For purposes of this report, felsic volcanic rocks were separated into calc-alkaline and tholeiitic affinities by the plot shown in Figure 7 (after Irvine and Baragar 1971, p.528, 536). The felsic metavolcanics of this map-area are all of tholeiitic affinity. Economic implications of the compositions of the felsic metavolcanics are discussed in the "Economic Geology" section.



LEGEND

- Onaman Lake area: Northern Onaman L. area, Thurston, this report; Teshote area, Amukun 1977a; Gledhill L. area, Amukun 1977b.
- O_T Average oceanic tholeiite (Manson 1968).
- G_T Uchi Lake area, average basalt (Goodwin 1967).
- C_T Average continental tholeiite (Manson 1968).

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Figure 5–Plot of CaO-Al_2O_3-MgO (weight percent) for basaltic rocks in the Onaman Lake vicinity.

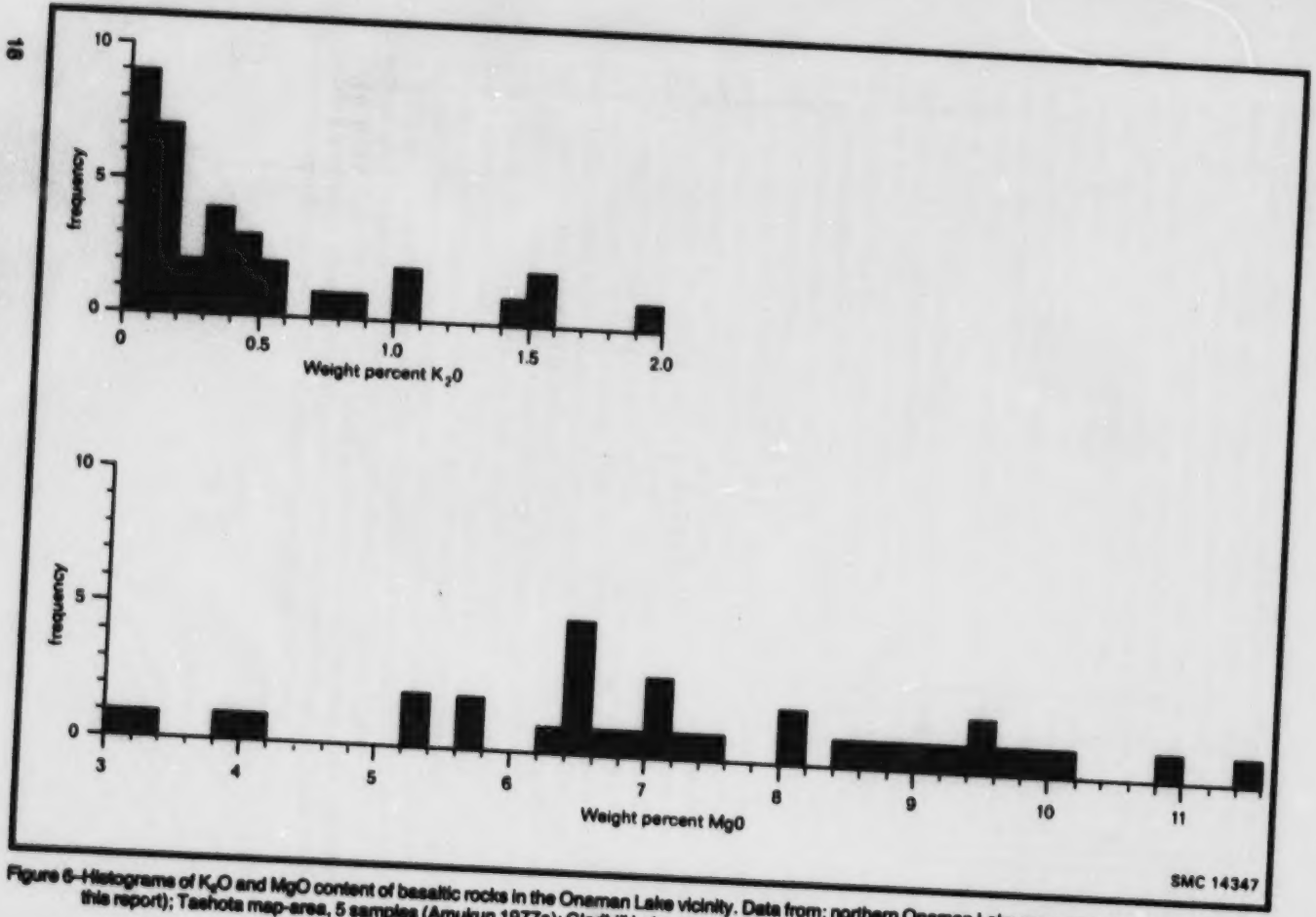

Figure 6–Histograms of K_2O and MgO content of basaltic rocks in the Onaman Lake vicinity. Data from: northern Onaman Lake map-area, 5 samples (Thurston, this report); Tashota map-area, 5 samples (Amukun 1977a); Gledhill Lake map-area, 25 samples (Amukun 1977b).

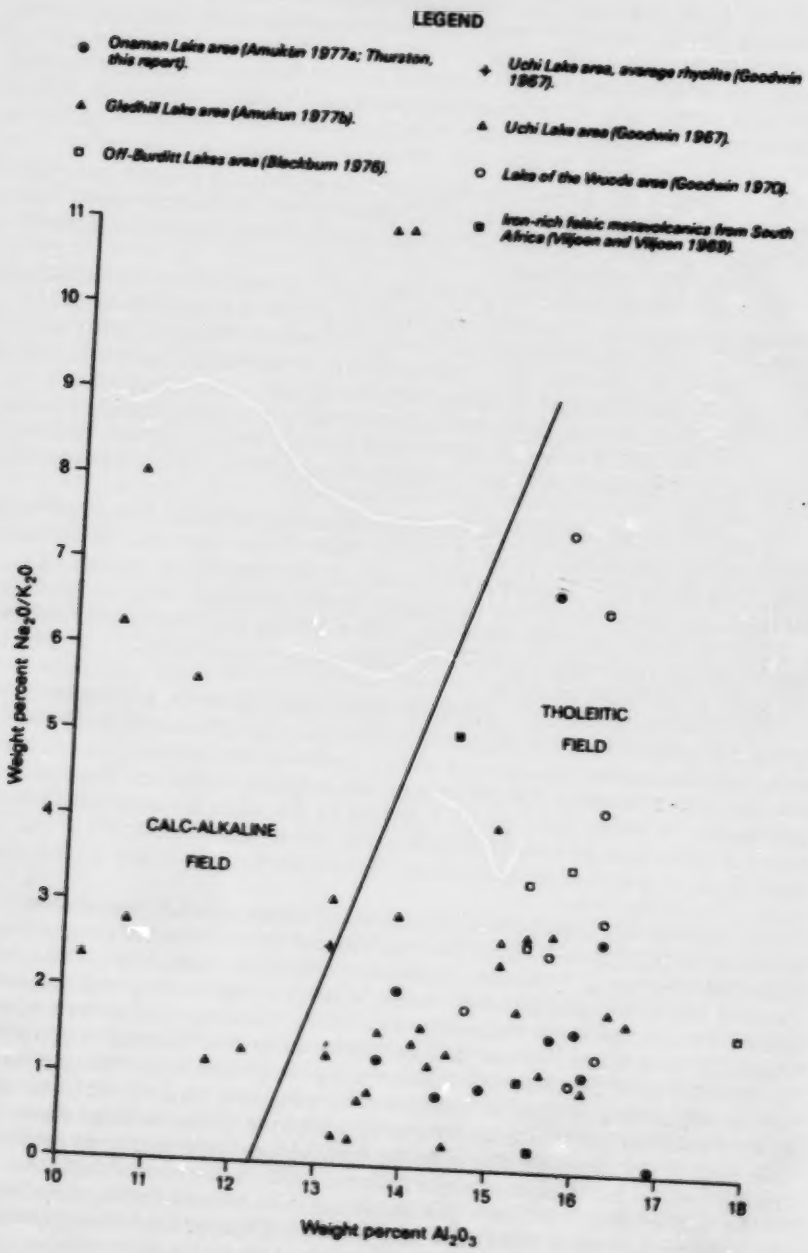

Figure 7–Plot of Na_2O/K_2O vs. Al_2O_3 for felsic metavolcanics in the Onaman Lake vicinity, illustrating tholeiitic and calc-alkaline affinity.

Metasediments

IRON FORMATION

Gross (1965, p.83) defined iron formation as containing greater than 15 percent iron. In general, a section to be mapped as iron formation would have a minimum of one-third the exposed thickness consisting of either magnetite or pyrite-pyrrhotite bearing beds.

The major occurrence of iron formation is a band of dominantly oxide facies material, associated with mafic metavolcanics, with a maximum thickness of 20-30 m which is exposed over a strike length of 1000 m, lying 80 m to the north of the shaft of the Tashota mine. The existence of an iron formation unit about 300 m south of the Tashota mine on claim 536 is inferred from an occurrence of an angular, frost heaved boulder of sulphide facies iron formation in this location and it is possible that this unit correlates with several exposures of a narrow band of oxide facies iron formation found south of the main road on claims 4773 and 5018.

A 3 m thickness of rusty weathering lean sulphide facies ferruginous chert occurs on the northwest corner of claim 2194, 1 km northeast of McDonald Lake. This occurrence forms the northwest edge of an outcrop ridge and is exposed over only about 10 m. It is correlated, to the northeast, with an occurrence of frost-heaved boulders of massive pyritic material and a band of oxide facies iron formation occurring near the north boundary of claim 2192. This band is 6-9 m thick at the latter location.

The three bands of iron formation described all occur on the southeast side of the main felsic metavolcanic unit. Based upon the structural analysis of the area, iron formation should occur to the northwest but correlative units were not observed in outcrop. However, possible sulphide facies iron formation was intersected in holes 72-7 and 72-8 drilled by Noranda Exploration Company Limited and a narrow area of magnetic attraction was noted north of the Onaman River. A single outcrop of oxide facies material was found 2.6 km southwest of Coughlan Lake.

In outcrop, the iron formation consists of 1-3 cm thick layers of cherty material with interspersed layers from 0.5 cm to 4 or 5 cm thick of magnetite rich material with up to 5 percent hematite ± chlorite ± amphibole. The cherty bands weather white to grey, are more resistant to weathering and stand out in relief (≈ 2 mm) from the magnetite-rich bands. Bedding is often contorted tectonically, as indicated by unfilled, or calcite filled microfractures up to 5 mm thick, or by penecontemporaneous slumping which has produced extreme contortion of bedding in several outcrops. Mapping at a scale of 1 inch to 40 feet (1:480) near the Tashota mine by Tashota-Nipigon Mines Limited shows parasitic folds in the iron formation and the development of thinning on the limbs of the folds and some thickening, by a factor of 1.5-2, in the nose of the folds.

In thin section, the chert-rich bands are seen to contain 90 percent quartz grains ranging from 0.15 to 0.20 mm, somewhat coarse for a chert, indicating some degree of metamorphic recrystallization.

There are occurrences of thin (<15 cm) interbeds of pelitic material in the

oxide facies iron formation. In particular, flaggy cleaving, black to brown weathering rocks of lithwacke composition (after Williams *et al.* 1954) occur in the iron formation unit north of the Tashota mine. The mineral assemblage of the lithwacke consists of quartz and feldspar (70 percent, dominated by quartz) biotite (25 percent), magnetite ± sphene (5 percent) with traces of epidote, chloritoid and pyrite. The assemblage described is not diagnostic, but would appear to indicate metamorphism to the greenschist facies of Turner (1968, p.277).

Sulphide facies iron formation consists of 1-3 cm thick layers, of pyrite with minor pyrrhotite separated by layers of about equal width, of cherty and pelitic metasediments. The maximum total width observed was about 3.5 m in the unit lying within the felsic metavolcanic unit on claim number 4722. This rock type was not examined in thin section.

The iron formation located immediately north of the Tashota mine road on claims 523 and 524 consists of mixed oxide and silicate facies iron formation, with the latter tending to be more common in the lower, southern part of the unit. The silicate rich material occurs as beds up to 10 mm thick interbanded with oxide facies material. In outcrop, the silicate-rich bands consist of green acicular amphiboles up to 2.5 cm long forming persistent beds interspersed with rusty weathering cherty beds of about the same thickness. In thin section the silicate rich units are seen to consist of magnetite (up to 10 percent) ± quartz (20-30 percent) ± stilpnomelane (5 percent) ± amphibole of the tremolite-actinolite series (55 percent) (confirmed by X-ray diffraction by Geoscience Laboratories, Ontario Geological Survey) ± carbonate. Klein (1973, p.1083) indicated that this assemblage is typical of "medium-grade" metamorphism.

The oxide and silicate facies iron formation exposed in the map-area are associated with mafic metavolcanics. The exposed sulphide facies iron formation is associated with the felsic metavolcanics. The information available is too limited, however, to affirm that this is a consistent association.

CLASTIC METASEDIMENTS

There is a small occurrence, only about a metre wide, of hornfelsic pelitic metasediment located 240 m west of Barn Lake. The unit is bounded on either side by mafic metavolcanics. It forms a rusty weathering unit with a grey fresh surface and composed of 1 mm biotite grains in an aphanitic matrix. The unit was not traceable for more than about 30 m along strike due to lack of outcrop. Bedding is defined by variations in mafic mineral content. In thin section the rock is seen to be composed of: poikiloblastic biotite with quartz and feldspar inclusions (20 percent); kyanite as anhedral grains (15 percent); quartz and feldspar as a fine-grained (0.02-0.25 mm) groundmass (40 percent); scattered magnetite grains (10 percent); garnet (2-5 percent) and up to 10 percent chlorite. The assemblage and textures and the development of biotite ± kyanite as porphyroblasts up to 0.24 mm in diameter would indicate metamorphism to the hornblende hornfels facies (Turner 1968, p. 223). A single outcrop of cobble paraconglomerate with clasts up to about 20 cm in their maximum dimension occurs 150 m west of the Tashota mine road near the southern boundary of the

area. The large clasts are mostly well rounded plutonic igneous rocks, and occasional smaller (average 5 cm maximum dimension), flattened 3:1 clasts of felsic metavolcanics form a minor part (10 percent) of the clast population. The total number of clasts in the above size-ranges constitutes 30-40 percent of the rock. Another 20-30 percent consists of pebbles and granule-size fragments, usually sub-angular in shape, composed of vein quartz, felsic plutonic rocks, and almost indistinguishable granules of chloritic mafic metavolcanics set in a matrix of chloritic greywacke. The rock type was not examined in thin section. The unit is part of the larger sequence of conglomeratic rocks described by Moorhouse (1938, p.8,9)

METAMORPHOSED MAFIC INTRUSIVE ROCKS

GABBRO

The main mass of gabbro in the map-area forms a stock covering an area of 2.6 km^2 between Nowlan and Barn Lakes. The stock is intrusive into the surrounding mafic metavolcanics as shown by development of more intense saussuritization of the metavolcanics over a distance of up to 350 m from the contact, by development of albite and epidote veins 5-10 mm thick in the immediately surrounding metavolcanics, and by the presence of intrusive apophyses of gabbro in the metavolcanics along the west contact of the stock. The gabbro of the stock is also extensively saussuritized.

The gabbro has a white to grey weathered surface and a white to grey fresh surface which commonly displays a gabbroic texture defined by laths of hornblende, which form up to 40 percent of the rock, set in a groundmass of saussuritized plagioclase. Average grain size is 5 to 10 mm. In places, in no apparent pattern, zones occur in which large phenocrysts of plagioclase up to 2.5 cm occur in medium to coarse grained gabbroic groundmass.

In thin section the finer grained material is seen to consist of hornblende which is pleochroic in shades of yellow and light green and occurs in relict phenocrysts up to 2 mm long by 0.2 mm wide in a matrix of albite and epidote with accessory quartz, chlorite after hornblende, carbonate and sphene.

Several medium to coarse grained conformable gabbroic textured bodies and sheets occur within the mafic metavolcanics. The sheets range from 30 m to 100 m thick with a lateral extent of up to 1400 m. Intrusive relationships were observed occasionally between the two rock types; it is possible however that some occurrences of the gabbroic textured rock represent coarse-grained flow centres. The principal occurrences are *1)* south of the Onaman River on claim 2189, *2)* 60 m east of MacDonald Lake, *3)* just west of the southern part of MacDonald Lake and in several discontinuous patches of texturally similar material northwest of Jenkins Lake which probably represent coarser textured flows. The small body of diorite (Tindale 1967) at the Tashota mine is also similar to these occurrences in texture and grain size, while in form it is stock-like rather than conformable.

The weathered surface of the gabbroic rocks varies from dark to light green

and 2-4 mm hornblendes give a pebbly appearance to the surface. The fresh surface in the finer grained examples is dark green, but where the grain size approaches the maximum of 5 mm, a grey-green fresh surface is more common.

In thin section the gabbroic rocks consist of phenocrysts of hornblende, pleochroic in pale green and clear shades, minor amounts of clear amphibole of the tremolite-actinolite series, a groundmass of saussuritized plagioclase with numerous grains of epidote 2 by 1 mm and no visible twinning. The accessory minerals include scattered traces of magnetite, chlorite after amphibole in small amounts (< 1 percent) traces of biotite and sericite. The texture ranges from ophitic to subophitic.

It is believed by the author that most of the occurrences of coarse-grained mafic rocks are intrusive sills, in particular those such as the body east of MacDonald Lake, in which coarse plagioclase (≈ 5 mm) is common in slightly finer grained groundmass, and in which the coarser grained phase is plagioclase. Where the coarse grained phase is hornblende, the grain size is generally slightly finer and obvious intrusive relations between the coarse grained rock-types and the surrounding metavolcanics are not encountered so frequently.

FELSIC IGNEOUS AND METAMORPHIC ROCKS

Migmatitic Rocks

Migmatite underlies the eastern part of the map-area centred on Onaman Lake. The bulk of the material consists of biotite-quartz-feldspar gneiss occurring in layers from a centimetre to several tens of metres thick. There are several small units generally 30 cm to 3 m thick toward the south part of Onaman Lake in the map-area that consist of amphibole and plagioclase with a poorly developed gneissosity. Both rock types are cut by concordant and crosscutting pegmatite bodies which occur at random and are from a centimetre to several metres across (Photo 2). These bodies are usually relatively coarse grained and generally have little if any development of a melanosome (mafic selvage) (Mehnert 1968). They cross cut both paleosome and neosome.

The leucosome, which varies in amount from nil in several large outcrops to 90 percent or more in others is usually injected *lit-par-lit* into the paleosome. The paleosome composition, in igneous nomenclature, ranges from biotite tronDhjemite to granodiorite. In sedimentary terminology it would correspond to a greywacke to arkose composition. In thin section, the paleosome displays a medium-grained granoblastic texture and consists of plagioclase An_{18-30} (up to 40-50 percent), microcline (20 percent), quartz (20-30 percent) with embayed, sutured grain boundaries, biotite (10-15 percent) and accessory sericite, epidote, sphene, apatite and magnetite. This also corresponds to a greywacke composition. Poorly developed relict bedding on the order of 1 cm to 20 cm thick is defined by variation in biotite and feldspar content. No large phenocrysts of mafic minerals are present in the paleosome, nor are there large oriented porphyroblasts of feldspar. Grain size in the paleosome is relatively constant. Interbeds of pelitic composition were not found. On the basis of the above criteria it is thought that the paleosome is of metasedimentary origin.

OGS 10 197

Photo 2–Metatexitic migmatite. The paleosome consists of amphibolitic material cut by numerous veinlets of alaskitic granitic material. The outcrop is on the shore of Onaman Lake.

The structures displayed on a mesoscopic scale consist of *lit-par-lit* injection of neosome with occasional development of schollen, phelebitic and stromatic structures (Mehnert 1968, p.10).

The origin of the neosome is open to speculation. The paleosome upon occasion shows development of a fringe up to 5 mm wide which is richer in mafic minerals particularly in the areas of metasedimentary paleosome. This melanosome plus the observation that the neosome composition plots near the ternary minimum in the system albite-orthoclase-quartz suggests an anatectic origin of at least some of the neosome.

The neosome is quite leucocratic with less than 5 percent combined biotite plus muscovite and seems, on the basis of mineral identification in the field to be of granite composition (Photo 3).

Felsic Intrusive Rocks

There are four bodies of granitic rocks within the map-area which are compositional and texturally distinct. The batholith bordering the northwest edge of the metavolcanic belt is medium to coarse grained, relatively uniform biotite quartz monsonite. The intrusive body southeast of the belt lying principally west of Onaman Lake consists of biotite quartz monsonite to granodiorite. A

OGS 10 198

Photo 3–Migmatized metavolcanics. The amphibolitic paleosome occurs as small rafts in a granitic neosome. The outcrop occurs on the shore of Onaman Lake.

pluton north of Onaman Lake which underlies an area of several square kilometres is relatively uniform medium- to coarse-grained biotite granodiorite. A small, oval shaped stock intrudes the mafic metavolcanics along the Onaman River east of Coughlan Lake. The stock is in the biotite granodiorite compositional range.

The granitic rocks along the north margin of the metavolcanic belt are clearly intrusive into the belt as evidenced by numerous xenoliths of metavolcanics in particular within 100 m of the contact. Sills of granitic rocks up to 7 m across are common in the mafic metavolcanics within 100 m of the contact with the batholith. The batholith is composite in nature with at least three phases present. However the scale of mapping prohibited a detailed examination of the extent of each phase and their age relations. In the area of Barn Lake and the full length of the North Onaman River within the map-area pink weathering biotite quartz monzonite to granodiorite predominates. It displays a hypidiomorphic granular texture in which one to three grains of biotite form 10-15 percent of a thin section of the rock, surrounded by up to 30 percent potassic feldspar, about 10-15 percent quartz and the remainder plagioclase feldspar. Thin section examination discloses plagioclase in the range An_{5-10} with some evidence of normal zoning and commonly sericitized to a moderate degree. Potassic feldspar commonly occurs as phenocrysts on the order of 5-10 cm in size, and is commonly microcline with rod, braid and patch perthite. Occasional myrmekitic intergrowth of quartz and albite was noted. Biotite does not usually ex-

ceed 5-10 percent. Quartz occurs as anhedral slightly strained grains with incipient mortar texture at some grain boundaries. Accessory minerals include: chlorite, epidote, sericite, sphene, magnetite and apatite.

Along the North Onaman River is a body about 3.6 by 1.6 km of medium- to coarse-grained gneissic biotite trondhjemite containing 5-10 mm, angular grains of quartz (20 percent), fine-grained biotite (5-10 percent), coarse granular plagioclase, and less than 10 percent porphyroblasts of potassic feldspar. The rock is interpreted as gneissic trondhjemite of probable igneous origin. In addition, contaminated phases of the above trondhjemite with up to 35 percent mafic minerals consisting of 2 mm clots of hornblende ± biotite in a matrix of 1-2 mm grain size consisting of 20 percent potassic feldspar and 40 percent plagioclase and negligible quartz is interpreted as contaminated mafic metavolcanics based on *1)* proximity to the contact, *2)* the mafic mineral assemblage and *3)* colour index.

There is a tendency for the northern part of the batholith to be more leuocratic and richer in potassic feldspar than the southern part, with quartz monzonite compositions toward Barn Lake, and trondhjemite compositions to the south near Pauloski Lake.

The stock south of the metavolcanic belt lies between the belt and the migmatites of Onaman Lake, and extends from the south boundary of the area northeast for about 13 km, attaining a maximum width of about 6 km close to the south boundary of the area. The stock is poorly exposed, and several phases appear to be present, based on the limited data available. There appears to be a range from quartz monzonite through trondhjemite compositions with biotite the predominant mafic mineral. The more trondhjemitic material is in general coarser grained and is found closer to the belt, usually within 400 m, suggesting an origin by contamination by the supracrustal rocks. Quartz veins, usually less than 5 cm thick, occasional narrow pegmatitic dikes and aplite dikes are relatively common. Thin section examination discloses heavily sericitized oligoclase (30-50 percent), perthitic orthoclase (up to 20 percent)with braid, strings and patches of albite enclosed, biotite ± muscovite (10-15 percent) occurring as intergranular clots with biotite predominating, and accessory amounts of magnetite, apatite, carbonate and sphene. These rocks are commonly foliated, with large (up to 10 mm) plagioclase phenocrysts defining a crude foliation in an extremely granulated matrix. The mafic minerals are commonly found wrapped around the plagioclase phenocrysts.

North of Onaman Lake a stock of hornblende granodiorite underlies an area of several square kilometres. Most outcrops of this stock have a pink weathered surface with a hypidiomorphic granular texture. A poorly developed, probably primary, foliation is present. Average grain size is 5-10 mm although some outcrops display a fine (1-2 mm) grain size. The contacts of this stock with the surrounding granitic rocks are not exposed. However it is found in contact with the mafic metavolcanics on the Onaman River due east of Nowlan Lake. The southern contact of this stock is defined by a sharp gradient about 1.6 km south of the North Onaman River on aeromagnetic maps 2144G and 2137G (ODM-GSC 1962a,b). Age relationships between this stock and the granitic rocks to the south are unknown. The stock possibly represents one of several phases of a major batholith emplaced along the contact between the metavolcanics of the belt and the paragneisses to the south.

TABLE 3 | MODES OF GRANITIC ROCKS, NORTHERN ONAMAN LAKE AREA.

	Stock east of Coughlan Lake		Batholith northwest of metavolcanic belt				Batholith southeast of metavolcanic belt			Stock north of Onaman Lake	
	1-25-2	1-25-2	3-3-1	3-3-8	3a-1-1	5-1-2	1-15-7	1-15-3a	1-15-4a	2-8-1	2-12-7
K-feldspar	6.9	9.0	38.2	23.2	27.2	26.8	0.8	-	38.3		21.2
Plagioclase	55.0	45.8	29.0	26.2	35.2	38.0	62.4	64.5	33.1	50.4	49.4
Quartz	28.6	25.6	29.2	45.5	20.8	25.0	26.8	18.5	24.2	2.0	5.4
Sericite	-		tr.				2.0				
Muscovite			tr.								
Biotite			3.2	4.3			7.2			6.0	14.1
Chlorite	7.0	12.6			12.0	6.6		14.5	3.6		
Epidote	2.0	6.5	0.4	tr.							0.8
Carbonate		tr.	tr.		0.6	2.2					
Sphene	2.0	0.5		tr.			0.8	2.0	tr.	1.6	0.8
Magnetite		tr.	tr.	0.1	0.6	tr.			tr.		0.1
Zircon						tr.			tr.		
Amphibole				0.7		0.4				38.4	6.2
Apatite										1.6	0.1

In thin section the rock consists of: 40 percent andesine (An_{40}) which is moderately to severely altered to epidote and sericite (10 percent) and commonly occurs as albite twinned phenocrysts up to 7 by 4 mm; microcline as intergranular anhedral grains up to 1-2 mm (30 percent); quartz (15 percent) as rounded anhedral grains about 0.5 mm in the long dimension and as 0.10 mm inclusions in poikilitic amphibole grains; amphibole (2-30 percent); biotite (15 percent maximum); and accessory sphene, magnetite, epidote, apatite and chlorite.

A relatively small stock of granitic rock is centred on the Onaman River about 0.8 km east of Coughlan Lake. The stock has dimensions of 3.7 km east to west by 1.4 km north to south. No contacts with the surrounding mafic metavolcanics are exposed, and the body is assumed to be post-tectonic and diapiric in nature simply on the basis of its location surrounded by folded metavolcanics. The outcrops weather pink and consist of well foliated biotite granodiorite with 2-4 mm plagioclase phenocrysts. In thin section, the rock is seen to be porphyritic with 2-6 mm plagioclase phenocrysts (An_{25-30}) strongly altered to sericite and epidote with finer grained interstitial microcline (15 percent), anhedral quartz (20 percent), and between 10 and 15 percent combined biotite and light green chlorite (believed by the author to have replaced hornblende) with accessory amounts of epidote, carbonate, sphene and magnetite.

Modes of the granitic rocks are listed in Table 3.

Middle and Late Precambrian (Proterozoic)

MAFIC INTRUSIVE ROCKS

DIABASE DIKES

Three major diabase dikes occur in the map-area. The first, which strikes just west of north, outcrops on the road about 2 km west-northwest of the southern part (in the map-area) of Onaman Lake. This dike is traceable on aeromagnetic map 2137G (ODM-GSC 1962a) for about 6 km within the map-area. The aeromagnetic expression consisting of a narrow "low" is lost at about the southern granite-metavolcanic contact. However, it is traceable within and just south of the belt by scattered outcrops. A small subsidiary dike lies just west of this centered on the above road.

The second major dike strikes northwest and is exposed on an island and the northern and southern shores of Onaman Lake. The third major dike is exposed in a single outcrop 1.8 km northwest of the North Onaman River, eventually passing close to the northerly trending segment of Metcalfe Creek. This dike also has a prominent aeromagnetic expression on the aeromagnetic map. All dikes are about 30 m wide, have a brown pebbly weathered surface and have developed prominent joint sets striking perpendicular to the strike of the dike. The fresh surface displays a diabasic texture with laths of plagioclase up to 5 mm long enclosed in a matrix of pyroxene. Thin section examination dis-

closes laths of plagioclase (An_{55}) composing 50 percent of the rock, augitic clinopyroxene 25-30 percent, amphibole 15 percent and accessory magnetite, biotite and quartz.

The northwesterly trending dike is a possible member of the "Sudbury" swarm of Fahrig *et al.* (1965, p.284) which was dated by the Rb-Sr method at 1660 ± 145 m.y. (Gates 1971, p. 36). Dikes to the north of the Onaman Lake area have been dated by K-Ar methods and ascribed to the Sudbury swarm also (Fahrig *et al.* 1965). The northerly trending dikes are probably part of the "Marathon" swarm of Fahrig *et al.* (1965, p.291) with an approximate age, by K-Ar methods of 1810 m.y.

Cenozoic

QUATERNARY

Pleistocene and Recent

As described under "Physiography", the area is relatively flat, with extensive deposits of sand and sandy till in the area of Onaman Lake. The direction of ice flow deduced from glacial striae was to the west-southwest. This flow direction was associated with the Nipigon phase of glaciation (Zoltai 1965, p.262). The major topographic feature affecting the area is the Onaman interlobate moraine which lies north of the map-area in Oboshkegan Township (Zoltai 1965, p.255). Its associated outwash deposits, mainly sand and sandy till, cover the area south of Metcalfe Creek, the North Onaman River and the area of sparse outcrop between this and the Onaman River. The latter is bounded on the north side by bouldery hills with poor outcrop. In fact the rapids at the north end of MacDonald Lake is composed of rounded boulder debris with no visible bedrock. The esker indicated on the map at Jenkins Lake is continuous over a distance of about 4 km and consists of a sandy ridge 6-9 m high.

Treed swamps particularly north of Onaman Lake are dry and heavily forested enough to have been cut over.

Varved clays are found in the lower part of the valley of the Onaman River, and are quite prominent just west of the map area. They extend east, up river, as far as the area between MacDonald Lake and the Tashota mine road. These deposits are the result of Glacial Lake Nakina, the last remnant of which is Onaman Lake, occupying a broad clay- and sand-filled topographic low.

Recent deposits include lacustrine and fluvial clay and sand and organic rich mud currently being deposits in swamps. It is largely recent activity which has winnowed fine material from Pleistocene deposits to produce the boulder-filled rapids so common on the Onaman River.

Muskeg is particularly extensive in areas underlain by clay between the Onaman River and Onaman Lake, and just south of Metcalfe Creek. Outcrops in these areas tend to be low, infrequent and surrounded by muskeg. On the map the larger open areas of muskeg are indicated by swamp symbols as are

the more common spruce and cedar swamps.

STRUCTURAL GEOLOGY

Foliation, Schistosity, Cleavage, and Gneissosity

Foliation in the metavolcanics is defined by an almost parallel arrangement of platy and acicular minerals such as biotite, chlorite and hornblende. Foliation is well developed in the mafic metavolcanics commonly passing transitionally into a fairly well developed gneissosity toward the granitic rock contacts. Stretching of pillows, and of clasts in the pyroclastic rocks also produces a readily recognizable foliation. The foliation generally parallels bedding except in the vicinity of major faults, such as the north-trending fault which follows the Onaman River south of Coughan Lake. Adjacent to major faults a strong schistosity is developed, often at a high angle to bedding. Minor divergence of foliation from bedding is common on the north bank of the Onaman River in the mafic metavolcanics. The divergence between foliation and bedding is quite apparent in the pelitic interbeds in the iron formation just north of the Tashota mine, where biotite alignment defines a foliation striking at about 30 degrees to the strike of the bedding. In the felsic pyroclastic rocks foliation defined by arrangement of muscovite grains is seen to occur at a similar acute angle to bedding just east of MacDonald Lake. The discordant foliation may be due to the second folding of the metavolcanic-metasedimentary belt about northwest-trending axes.

Foliation consisting of subparallel alignment of mafic grains, elongated feldspar grains and xenolithic inclusions is well developed in the granitic rocks and is thought by the author to be igneous in origin because, in part, of the parallelism of the foliation to the contacts of the various stocks.

Lineation

Secondary lineations comprise parasitic fold axes, particularly in the migmatites of map-unit 5, crenulations in the micaceous metasediments and pyroclastic rocks and intersection of foliation and bedding. Two major sets exist, a nearly vertical plunging set composed of stretched clasts and mineral lineations which is caused by primary folding, and a set plunging at 40-60 degrees in a north to northwesterly direction, coincident with plunge of secondary fold axes.

Joints

Joints occur in most rock types, but are best developed in the more competent units such as the iron formation, the felsic metavolcanics and the granitic

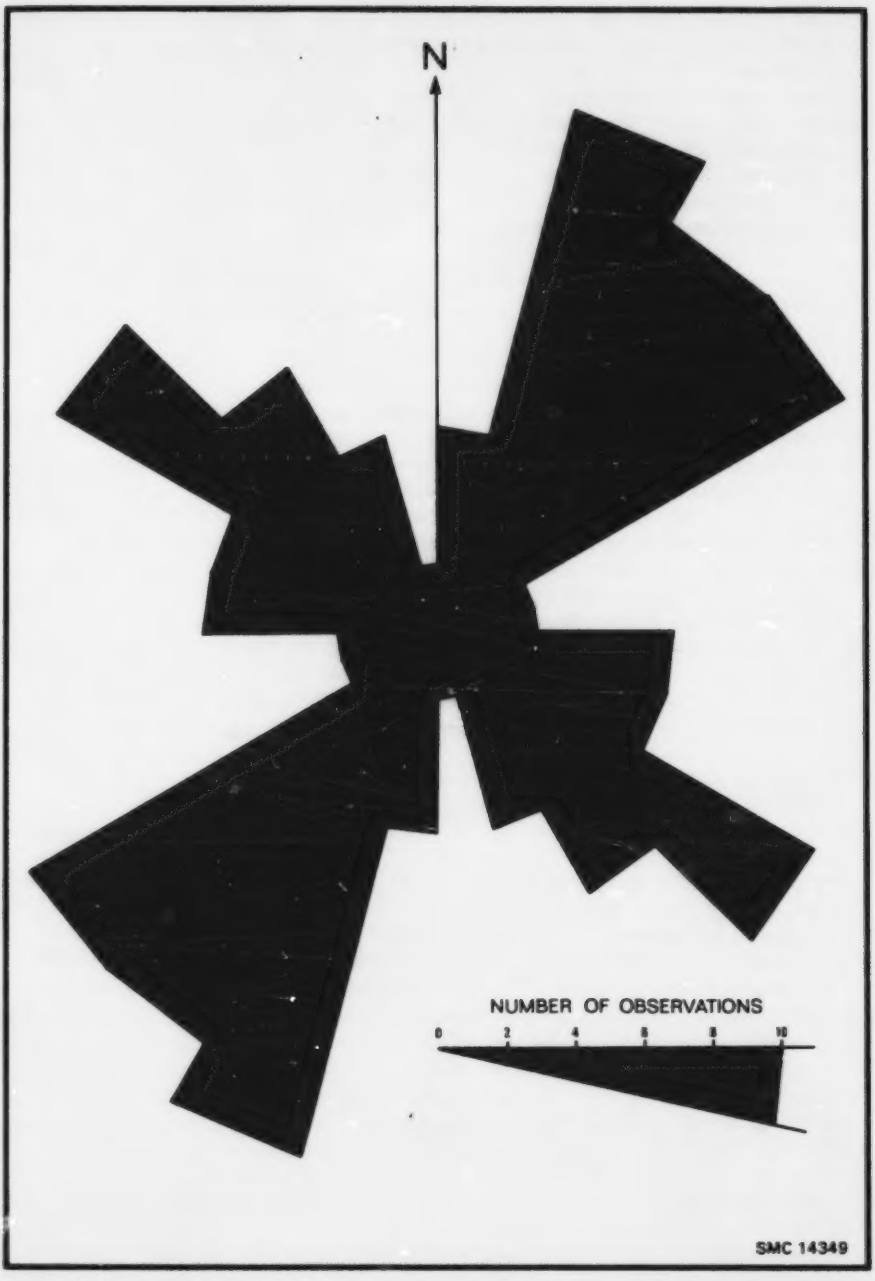

Figure 8–Rose diagram (symmetrical representation) of joints in the Northern Onaman Lake area.

rocks. A plot of joint attitudes (Figure 8) on a rose diagram shows maxima in the northern Onaman Lake area as follows:
1) major set: strike 310° dip 65-80°NE.
2) major set: strike 230° dip 67-75°N.
3) minor set: strike 310° dip 80-90°NE.
4) minor set: strike 230° dip 65-78°S.

For the northern Onaman Lake-Tashota region (Amukun 1977a; this work), the joints group predominantly into a major steeply dipping set oriented N-S and a subsidiary steeply dipping set oriented E-W.

Major Folds

The traces of the axial plane of the major folds are plotted on the map face. Top indicators consisted mainly of pillow shape and packing in the mafic flows, and a few determinations based and on grain gradations in the finer grained portions of the felsic metavolcanic unit east of MacDonald Lake. Two groups of folds are postulated: *1)* an upright isoclinal fold which trends parallel to the length of the metavolcanic belt, and *2)* a set of minor folds plunging 55-60 degrees to the northwest which have been discussed by Flaherty (1936, p.729). The first group have been warped about nearly vertical axes as a result of the intrusion of the surrounding granitic rocks.

Within group 1 is a major syncline defined by southeast facing tops in the main pyroclastic unit and by northwest facing tops in the mafic flows. The trace of the axial plane passes up the centre of the pyroclastic unit east of MacDonald Lake to claim 4777 at which point neither further southeast facing tops nor the pyroclastic unit can be followed.

Minor Folds

A second set of folds was mapped by Flaherty (1936, p.729) at least in part on the basis of marker units such as chloritic flows seen only in underground exposures and flexures in the iron formation unit. See Figure 16 for details of these folds. These folds are described in more detail in the description of "Tashota-Nipigon Mines Limited". The difference in plunge and trend of these folds led Flaherty (1936, p.731) to the conclusion that they were formed during a second episode of folding, a conclusion supported by this author.

Faulting

The majority of the faults shown on the map-face are transcurrent to the strike of the formations and have produced relatively large structural offsets. However, as the area is one of low outcrop density, strike-slip movement if any would not be readily apparent. Faults are recognized on the basis of: *1)* lineaments and/or offsets visible on air photos, *2)* offsets visible on the aeromagnetic

maps, *3)* scarps visible on the air photos, *4)* development of schistose zones filled with alteration products, and *5)* pseudotachylite zones in the granitic rocks.

The northwest-trending fault lying 1.8 km west of the Tashota mine appears to offset the iron formation unit which occurs north of the mine and the southern metavolcanic-granite contact. However there is little displacement of units to the north. This fault does not appear to offset the northern metavolcanic-granitic contact, perhaps because of reduced horizontal displacement or, more likely, this northerly contact is largely geophysically determined and beyond the resolving power of 1 inch to 1 mile scale aeromagnetic maps.

The northwest-trending fault lying east of the Tashota mine has an apparent left lateral displacement of 0.6 km which is the result of largely vertical movement. The movement is considered to be largely vertical because of a sharp rise in metamorphic grade to the east of the fault in the metavolcanics contained on the easterly extension of the mine road. In addition, as the metavolcanic belt east of the fault is much narrower, and either the portions to the north and south have been stoped off into the granitic rocks or the belt becomes narrower with depth or both. The other faults of this trend have displacements of similar orders of magnitude. They were recognized through structural offsets in most cases.

The prominent lineament expressed by the north-south trend of the Onaman River 2.9 km to the west of the Tashota mine is believed to be a fault zone, based on assumed left lateral offset of the mafic lapillistone marker beds.

Shear zones occupied by the A and D vein systems of the Tashota mine are discussed in more detail under "Economic Geology". Both of these zones have an approximately E-W orientation, and are related to accommodation to movements involved in the northwest-plunging folds of set 2 (Flaherty 1936). Movement on these zones is indicated by the offset of underground exposures of the diorite body at the mine.

The above shear zones have a generally similar strike to the shear zone containing the brecciated quartz vein at location No. 1 of the Lynx-Canada *et al.* option.

ECONOMIC GEOLOGY

The map-area has a long history of prospecting, development, and production. About 1925 interest in the gold prospects around Tashota to the north on the Canadian National Railway spilled over into this map-area. Gledhill (1925, p.81) reported on the work of the Canada Mines Syndicate which included 500 m of trenching and channel sampling on claims 397 and 401 principally for gold mineralization. However at the time, galena, sphalerite, and chalcopyrite were noted. Additional prospects found at this time were the Currie prospect, the Johnson prospect, and the McKechnie prospect which later became the Tashota mine.

In August 1923, J. McKechnie discovered visible gold on claim 524. The claim group was optioned to the Nipissing Mining Company. In 1927, Tashota Gold Mines Limited was formed to carry out development work on the property,

but ceased activity in 1929. In 1934, Tashota Goldfields Limited, with participation by Minefinders Limited resumed development. The property was in production from 1934 to 1938, with total production of 12 400 ounces Au, 14 500 ounces Ag, and 575 000 pounds Cu (see Table 10).

The early 1950s saw a shift in exploration emphasis to base metals. Large parts of the map-area were staked (Figure 9), with the central properties being those of Headvue Mines Limited and Coulee Lead and Zinc Mines Limited. Headvue completed an electromagnetic survey, a ground magnetic survey, and 9000 m of diamond drilling on their property and a claim group optioned from Headway Red Lake Gold Mines Limited (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay). Headway Red Lake Gold Mines Limited and Coulee Lead and Zinc Mines Limited optioned their properties to Noranda Exploration Company Limited in June 1971.

GOLD

Gold is found in the map-area in association with pyrrhotite and chalcopyrite, in the native state, and possibly alloyed with silver as electrum, at the Tashota mine. While the orebodies bear a close spatial relationship to intrusive, quartz-feldspar porphyry and diorite, the gold is found in replacement quartz veins which are controlled by "shear joints" thought by Flaherty (1936) to be the conjugate joint sets symmetrically disposed about the axial surfaces of secondary folds in the mafic metavolcanics. As the mineralization was not observed by the author, this interpretation must be considered valid.

Numerous occurrences such as the Johnson, Canada Mines Syndicate, and Currie all consist of galena and sphalerite associated with pyrite in pyritic quartz veins filling shear zones, almost always in spatial association with feldspar porphyry dikes.

LEAD, ZINC AND SILVER REPLACEMENT BODIES

Coulee Lead and Zinc Mines Limited has claims covering a northeast-trending shear zone largely in felsic metavolcanics which extends from the southwest corner of claim 2192 to just beyond the northeast corner of 2189 a distance of over 1.6 km. One hundred and thirty metres to the northwest a parallel zone extends over a strike length of 1.2 km from the southwest corner of 2192 to the middle of the east boundary of 2810. These zones strike directly towards the Tashota mine. The zones are 5-7 m wide and consist of sheared felsic metavolcanics altered to sericite, carbonate, and white mica, and mafic metavolcanics altered to saussurite and chlorite. Sulphide blebs and massive sections up to a few centimetres thick and of no great length are found along these shear zones. The sulphides commonly consist of pyrite, yellowish sphalerite, and argenitiferous galena. Hopkins (1951), has indicated a total tonnage of both proven and possible material, in two zones, of 250 600 t with an average grade, recalculated by the author, of 45.27 g/t Ag and 4.44 percent Zn.

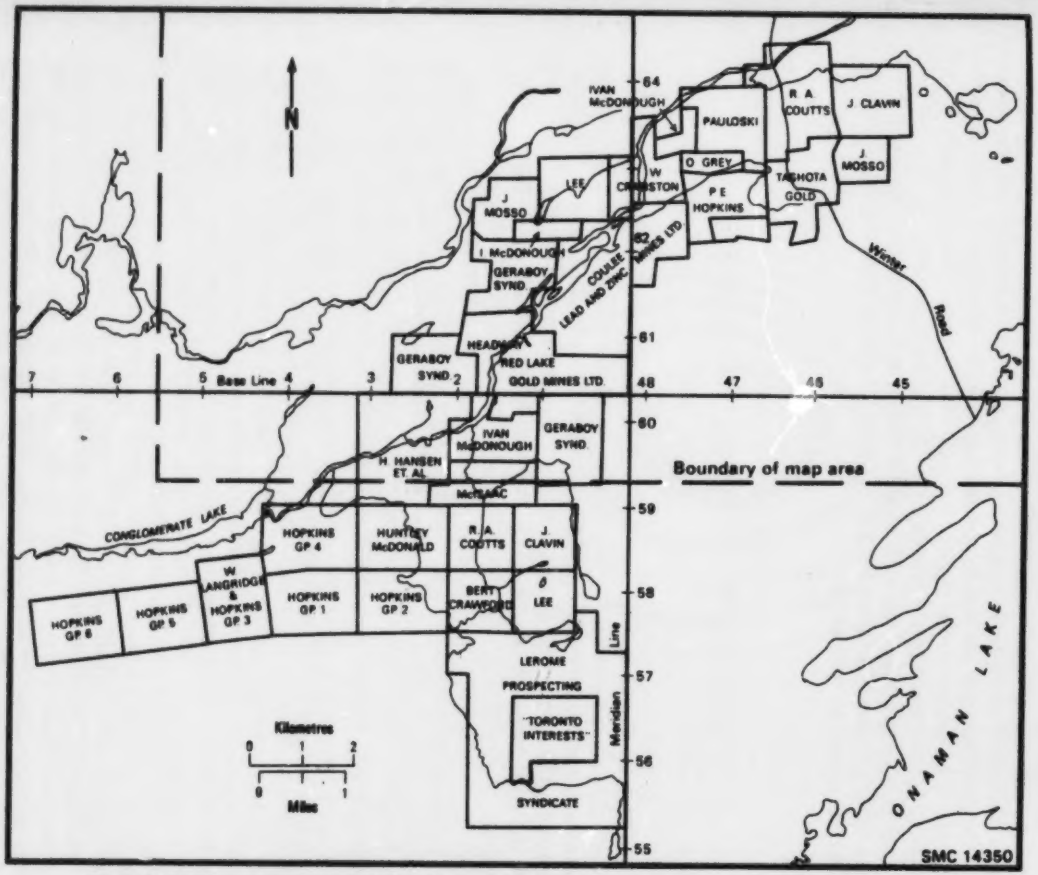

Figure 9–Claim ownership circa 1950 in Onaman Lake area. From map by W. Langridge in Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay.

On the Headway property, a shear zone extends from claim 2424 northeastward to claim 2194. The shear zone is filled with quartz carbonate and sulphides. The sulphides in the shear zones in the Headway Red Lake Gold Mines Limited and Coulee Lead and Zinc Mines Limited claims occur in two fashions.
1) Quartz carbonate veins with relatively massive sphalerite, pyrite, and galena cut felsic tuff and quartz-eye porphyry on the Headway and Coulee properties. The sulphides are present in the ratio sphalerite 50 percent, pyrite 30 percent, galena 15 percent, and chalcopyrite up to 5 percent. There appears to be an association between sphalerite and the higher silver assays.
2) Secondary pyrite occurs as a coating on fractures and sheared surfaces. The pyrite appears to be later than the sulphides of (1) above. The original source of this pyrite is open to speculation.

SYNGENETIC MASSIVE SULPHIDE BODIES

Drilling by Noranda Exploration Company Limited has indicated a thickness of sulphide facies iron formation of up to 24 m which contains, in order of abundance, pyrite, pyrrhotite, sphalerite, and traces of chalcopyrite (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). This unit is interbanded with the felsic metavolcanics east of MacDonald Lake. Based on the diamond drilling to date, this is the only syngenetic sulphide body of significant size found in the map-area except for the Lynx-Canada *et al.* body.

Scattered sulphides in concentrations up to 5 percent were often found in the felsic metavolcanics by the field party. These consisted mostly of pyrite with occasional sphalerite. These sulphides are considered by the writer to be syngenetic and may be the source of the material concentrated in the shear zones.

In general, felsic metavolcanics (SiO_2 > 68 percent) spatially associated with tholeiitic basalts and magnesian basalts (defined by Arndt 1976) have a high alumina content in the range 13-17 percent and an Na_2O/K_2O ratio between 0.2 and 4.5. Those felsic metavolcanics associated with calc-alkaline basalts have low alumina contents in the range 10-13 percent and an Na_2O/K_2O ratio ranging from 1 to 7. In addition, a ternary plot ($FeO + Fe_2O_3 + TiO_2$) - Al_2O_3 - MgO appears to separate felsic metavolcanics thought to be derived from tholeiitic basalts from those thought to be derived from calc-alkaline basalts (L.S. Jensen, Ontario Geological Survey, personal communication, 1975). It would appear, based on the above criteria that the felsic metavolcanics of the map-area are of the tholeiitic suite. The occurrence of large bodies of Cu-Zn-Ag-rich syngenetic massive sulphide orebodies associated with tholeiitic suite volcanic rocks is not well documented, with the exception of the Mattabi deposit at Sturgeon Lake (Shegelski 1976). In addition a plot of sulphur versus SiO_2 (Wolfe 1974) for the felsic volcanic rocks analyzed would suggest that the felsic metavolcanics in the map-area do not fall in the "anomalous" range.

A perusal of the literature for Precambrian massive sulphide deposits in association with felsic metavolcanics and the affinities of the enclosing rocks is summarized in Table 4.

TABLE 4 AFFINITIES OF MASSIVE SULPHIDE ORES ASSOCIATED WITH FELSIC METAVOLCANICS

Deposit	Magmatic Series	References
Copperfields	calc-alkaline	Jones (1973)
Abitibi Copper	calc-alkaline	Descarreaux (1972)
Louvem	calc-alkaline	Descarreaux (1972)
Beacon	calc-alkaline	Descarreaux (1972)
Dunraine	calc-alkaline	Descarreaux (1972)
Quebec-Manitou	calc-alkaline	Descarreaux (1972)
East Sullivan	calc-alkaline	Descarreaux (1972)
South Bay	tholeiitic	Thurston (in prep.)
Mattabi	tholeiitic	Shegelski (1976)
N.B.U.	tholeiitic	Shegelski (1976)
Kam Kotia	calc-alkaline	Pyke and Middleton (1970)
Jameland	calc-alkaline	Baragar (1968)
Canadian Jamieson	calc-alkaline	Jensen (1974, personal communication)

There is potential for a Maybrun or Coronation mine type orebody (Davies 1973; Goodwin 1970b; Froese 1969). This type is a copper-rich syngenetic horizon or exhalative replacement of mafic flows by Cu-rich sulphide minerals (*see* Lynx-Canada Explorations Limited *et al.* property description). The mineralized quartz veins found at the Tashota mine and at location No.2 of the Lynx-Canada *et al.* option are possibly derived from remobilized copper-rich syngenetic sulphide bodies associated with mafic flows.

Arndt stated (1976, p.25) that the "magnesian" series of basalts are associated with pyroxenite-gabbro flows with hyaloclastite tops containing Cu-Zn mineralization. This type of association is possible in the magnesian basalts of the map-area.

IRON

The iron formation of the area, in particular the oxide facies, is not thick enough nor rich enough in iron to be commercially exploitable at the present time.

CONSIDERATIONS FOR FUTURE EXPLORATION

Syngenetic exhalative copper deposits associated with the extensive development of tholeiitic basaltic flows may exist in the area (see above). Any so-called "formational", i.e. conformable, electromagnetic anomalies in the mafic metavolcanics ought to be investigated on this account.

Gold mineralization in association with secondary folds in the metavolcanics of the belt is possible. Detailed geological mapping should be carried out to the west of the Tashota mine, using the iron formations as markers, followed by prospecting for similar joint controlled mineralization east of the Tashota mine A zone. Westward extensions of the G and A zones of the Tashota property have yet to be established.

The readers attention is called to the discussion above for more detail on the types of syngenetic sulphide bodies to be expected in the map-area. In essence that section of the report suggests, on the basis of the chemistry of the metavolcanics, that copper-gold mineralization associated with the mafic flows is the most likely type of syngenetic mineralization to be found in the map-area.

Property Descriptions

BUFFALO RED LAKE MINES LIMITED [1952] (1)

Buffalo Red Lake Mines Limited is listed in the Canadian Mines Handbook (1952-1956) as having had an option on 15 claims immediately east of the Tashota mine. The claims were numbered 5557-5560 5616-5619, and 5621-5627. In early 1952 an electromagnetic survey was conducted and three conductors recommended for drilling. A total of five holes comprising 396.5 m were drilled (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). No significant conductors were encountered. The collar locations and core were not found during the survey. The claims have since reverted to the Crown.

COULEE LEAD AND ZINC MINES LIMITED (2)

The property's history began with Gregory Brennan who, in 1916 panned gold from oxidized outcrops containing galena and sphalerite on claim 4722 in the area known as Coulee veins 2 and 4 (Tyson 1949). The claims were staked in 1922 when gold was found about 1.5 km to the southeast by Brennan and partners. Tom Currie found a gold bearing quartz vein on claim 514 (now 2239) during the 1920s. Coulee Lead and Zinc Mines Limited became interested in the property in 1949. The claim numbers are 4719-4732 inclusive, 4769-4777 inclusive, 4977-4978, 4980-4981, 4802-4804 and 5018. Only claims in good standing as leased claims at the time of writing are shown on map[1]. This company carried out geological mapping, a dip needle survey and 1500 m of diamond drilling prior to July 1949 (Tyson 1949).

[1]Note that on the map the original survey (claim) numbers are shown. Claims 4723, 4725, 4726, 4731, 4732, 4769, and 4980 are 2189, 2191, 2811, 2193, 2192, 2810, and 2809 respectively on Map 2411.

The property was optioned in 1950 to McIntyre Porcupine Mines Limited who formed a new company, Carndesson Mines Limited to work on the property (named for Carmen Desson a prospector who found many of the original showings). Material furnished by Noranda Exploration Company Limited would indicate that the former company drilled about 3487.1 m of core in 26 holes in 1952. Hopkins (1968, p.4) stated that the property was believed to be under option to the Chubb-Stuart syndicate in 1968.

Hopkins (1951, p.8) in a report for the Chubb-Stuart syndicate recommended re-opening picket lines on the property followed by an induced polarization survey. It is not known whether this work was carried out.

The property was optioned to Noranda Exploration Company Limited (Figure 10) by Coulee Lead and Zinc Mines Limited in 1971. At that time the property consisted of 27 leased claims as indicated on Map 2411 (back pocket).

General Geology

The property is underlain by massive to foliated mafic metavolcanics with occasional pillowed horizons, and by all rock types of the felsic metavolcanic formation. The area of the property is cut by numerous northeast-trending shear zones. The main shear zone extends from the southwest corner of claim 4732 (2192 on map) to just beyond the northeast corner of 2189 a distance of over 1800 m. It is flanked, 120 m to the northwest, by a parallel zone which extends over a strike length of 1340 m from the southwest corner of 2192 to the middle of the east boundary of 2810. The shear zones occur over widths of up to 5-6 m and consist of felsic metavolcanics altered to sericite ± carbonate ± white micas, and mafic metavolcanics altered to saussurite and chlorite. Commonly the mineralization occurs in both schistose metavolcanics and in carbonatized equivalents. The carbonatized zones are rich in ankerite over widths varying from 0.3 m to 3 m and are commonly covered by gossan to depths of up to 0.3 m. The fresh rock underlying the gossan consists of sulphide minerals disseminated amongst altered fragments of the metavolcanic rock types. In most exposures the predominant sulphide is pyrite with subsidiary yellow sphalerite and galena. Individual surface showings are described below.

Mineralized Zones

VEIN NO. 1

Vein No. 1 on claim 4774 (Figure 11, Chart A, back pocket, "No 1 Zone", grid location 9200E 550S) consists of five parallel fractures in a shear zone with a maximum width of 4.5 m. The zone strikes N70-80E over a length of 60 m and dips 80N. The country rock is sheared mafic metavolcanics. The fractures are filled with quartz, carbonate and an average of 15 percent sphalerite, 15 percent galena, and up to 19 ounces Ag per ton across 1.2 m. (Hopkins 1949, p.2).

Northern Onaman Lake Area

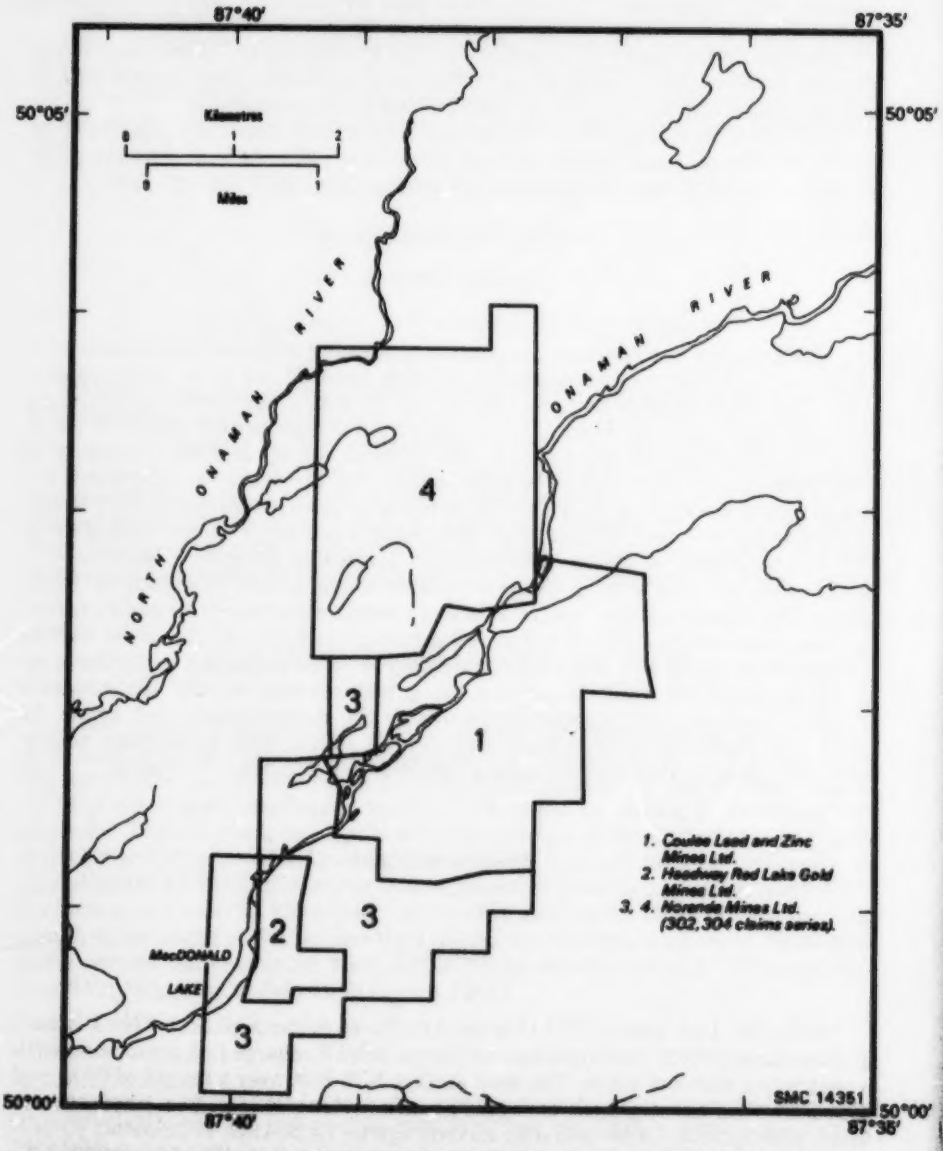

Figure 10–Claim ownership, 1971-1972 Noranda Exploration Company Limited option of Headway Red Lake Gold Mines Limited and Coulee Lead and Zinc Mines Limited properties.

The maximum width of any quartz lens is 0.5 m. A cross trench 11 m to the southwest exposed 0.30 m of sulphide-bearing material (Hopkins 1951). Eleven metres west of the latter, 5-15 cm of "almost solid sulphides" (Hopkins 1951) are exposed over a length of 6 m. Vein 1a, 60 m south, is about 25 cm wide and consists of quartz, carbonate, sheared metavolcanics with some galena and pyrite (Tyson 1949, p.17) and strikes N80E with a steep northerly dip.

VEIN NO. 0 (FORMERLY THE KIPPER VEIN)

Vein No. 0 lies on claims 4774 and 4777 (see Figure 11, "No.0 Zone", grid location 8000E, 500S). The country rock consists of schistose mafic metavolcanics with 3-5 percent feldspar phenocrysts, cut by a dike of dacitic, fine-grained quartz porphyry 30 cm thick, striking N40E and dipping 60NW. There are scattered small pods of quartz on the outcrop. About 40 m from the picket line the trench indicated in Figure 11 is in very poor condition, with a 20 cm quartz vein trending N85E with vertical dip in a trench 1.2 by 9 m trending at N05W. No mineralization was observed. Hopkins (1951, p.3) reported:

> The deposit which is about 10 feet or more in width consists of carbonate schist carrying about 30 percent irregular quartz veins with much pyrite and traces of galena. A grab sample gave $1.75 in gold. A vertical magnetite zone, 12 inches wide, lies 100 feet to the north.

VEIN NO. 2

Vein No. 2 (see Figure 11, "No.2 Zone") on claim 4772 is said by Hopkins (1951) to be exposed over a length of "about 400 feet". The author's assistants found the area to be one in which a zone of intermediate to felsic lapilli-tuff and tuff-breccia about 8 m thick is intercalated with medium- to coarse-grained mafic metavolcanics and two thin units of iron formation. Fragments in the lapilli-tuff and tuff-breccia average 5-7 cm and are intermediate to felsic in composition, weathering white in a dark grey matrix. Parallel to the tuff-breccia along the felsic metavolcanic-mafic metavolcanic contacts and in both rock types are a series of low weathering quartz-carbonate lenses oriented parallel to shearing, striking at N65E and dipping 70N north. Hopkins (1951, p.3) stated that the quartz carbonate is up to 1.5 m wide and carried in places "considerable" pyrite and some galena and very fine sphalerite. He remarked that the vein is in places lenticular. He cited a grab sample which yielded values of $2.10 gold (at $35 per ounce) and 5.38 ounces per ton silver.

Assays reported by Tyson (1949, p.18) are as follows:

	No. 7	No. 8
Au oz/ton	0.04	0.04
Ag oz/ton	3.04	4.20
Pb percent	1.45	0.06
Zn percent	4.42	5.09

No. 7 across 2 feet, pit on west side of road.
No. 8 across 2 feet, pit 16 feet west of sample No. 7.

Similar, but slightly lower results are quoted by Moffat (1974) for the location for Tyson's sample 8.

VEIN NO. 4

Vein 4 lies on the north-south meridian line between claims 2640 and 2810 (see Figure 11, "No.4 Zone", grid location 6400E, 075S). It was described by Hopkins (1951, p.3) as follows:

> It consists of silicified tuff or porphyry, carbonate, and quartz up to 5 or more feet in width and carrying, in places, up to approximately 10 percent pyrite and 2 percent galena and some zinc-blende. It occurs in a green and grey lava or tuff schist.

The vein strikes N80E and dips 80N and appears to the author to be in silicified mafic metavolcanics. Assays from two pits in the exposed 30 m length of the vein were reported by Tyson (1949, p.19) as follows:

	No. 15	No. 12
Au oz/ton	0.06	0.04
Ag oz/ton	4.30	5.1
Pb percent	3.34	n.d.
Zn percent	8.17	n.d.

The vein was not found by the field party, nor was it examined by crews of Noranda Exploration Company Limited in 1971 or 1972. Re-sampling by Noranda in 1974 gave the following results: Pb 1.6 percent, Zn 1.91 percent, Au trace, Ag 1.03 ounces per ton, Cu 0.04 percent (Moffat 1974).

VEIN SYSTEM 5

Vein System 5 occurs on claim 4722 (see Figure 11, "No. 5 Zone", grid location 3400E 700N) and is poorly exposed. At least four veins occur near the contact between what is described as "diorite" (Hopkins 1951) which the author believes to be chloritic mafic metavolcanics and crystal tuff, in a zone "100 feet" wide (Hopkins 1951, p.3). The veins are in a waxy appearing sericite-chlorite (chloritoid) schist cut by numerous quartz veins from 8 cm to 45 cm wide. The veins extend the length of the outcrop, about 30 m, trending N70E and dipping 80N. The zone of abundant quartz veins varies in width from 30 cm to 4 m. Disseminated galena and sphalerite occur in massive sections of pyrite. No material suitable for sampling was present upon examination by this survey of the only good exposure. Sampling in 1974 by Noranda Exploration Company Limited yielded an average, over 1.5 m, of Pb 0.68 percent, Zn 0.62 percent, Au 0.01 ounces per ton, Ag 2.97 ounces per ton (Moffat 1974). The vein system extends for about 140 m trending about N60E according to Hopkins (1951).

The zone was penetrated by 13 holes drilled by Coulee Lead and Zinc Mines Limited. This drill programme identified: vein 5a, about 15-18 m north of vein

5, and averaging 0.6 m wide by 76 m long. It occurs in coarse-grained dioritic mafic metavolcanics and was described by Hopkins (1951, p.3) as follows:

> It consists of brecciated quartz and schist with considerable pyrite and small amounts of zinc-blende, galena, pyrrhotite and chalcopyrite, and carries some gold and silver values.

Assays for this vein are tabulated below.

Vein 5b was also indicated in diamond drilling where it was found in holes 7 and 8 and traced eastward from there for 60 m in holes 5, 6, 4, 3, 2 and 1. Hopkins (1951, p.3) suggested that it could be the faulted easterly extension of vein 5. The average width is 1.6 m and overall length 45 m.

Tyson (1949, plan 49-3) gave average assay values from diamond drill core as follows:

	Vein 5	5A	5B	Average
Au oz/ton	0.51	0.020	0.036	0.035
Ag oz/ton	6.61	2.37	1.960	3.64
Pb percent	0.81	0.13	0.261	0.40
Zn percent	1.04	0.794	0.794	0.76

Noranda Exploration Company Limited drilled three holes beneath the Coulee No. 5 zone totalling 282 m. Average values for the zone from these three holes, located on Figure 11, average 0.4 percent Zn and 0.6 ounces Ag per ton (Moffat 1974).

FRIDAY VEIN FLOAT

On claim 4725 (2191 on map) at grid location 2500E, 650N (see Figure 11) a "large angular float" containing a 30 cm vein with disseminated pyrite, galena and sphalerite was found by personnel of Coulee Lead and Zinc Mines Limited. Hopkins (1951, p.3) gave further detail.

> A grab sample from the vein float gave 196 ozs. in silver. A pit through 8 feet of overburden near the float uncovered 12 inches or more of quartz carrying 25 percent pyrite and traces of zincblende and galena in a black siliceous tuff having the normal strike and dip.

The float boulder was assayed by Tyson (1949, p.121) with results as follows (both grab samples).

	S2	S4
Au oz/ton	0.09	0.01
Ag oz/ton	196.33	14.03
Pb percent	9.40	0.27
Zn percent	2.60	2.80

A pit excavated into overburden disclosed a mineralized quartz vein in bedrock of unspecified type striking N70E and dipping 75N. The quartz vein is mineralized with "up to 25 percent" (Hopkins 1951) pyrite, "probably less than

2 percent" galena, and less than 1 percent very fine red sphalerite. Tyson (1949, p. 21) reported assays as follows:

	S5	S6	S7
Au oz/ton	0.025	0.055	0.015
Ag oz/ton	1.02	9.98	2.28
Pb percent	tr.	1.08	tr.
Zn percent	0.40	0.60	2.61

The samples were described as follows:

S5 — fine massive pyrite in quartz and/or schist with some scattered fine red sphalerite.
S6 — fine massive pyrite in quartz and schist with 1-3 percent galena and some scattered fine red sphalerite.
S7 — fine massive pyrite in quartz schist with more fine red sphalerite than S5 and S6.

VEIN NO. 6

Vein No. 6 is located on claim 4769 (2810 on map) (see Figure 11, "No.6 Zone", grid location 6300E, 250N). The country rock to the north is fine- to medium-grained pillowed mafic metavolcanics which, in the area of the vein, are in contact with highly sheared intermediate to felsic crystal tuff. The rocks strike at N65E and dip 75N. The shearing trends N75E and dips 75N. Numerous pods of quartz up to 0.7 m by 3.6 m are found along the shear zone. No mineralization was seen by the field party. However, Tyson (1949, p.23) reported about 30 cm of pyrite, galena, and sphalerite mineralization in sheared carbonate in the bottom of a trench. He described a chip sample across 30 cm as yielding 0.02 ounces per ton Au and 8.40 ounces per ton Ag.

The vein was not exposed when searched for during this survey. Blasting by Noranda Exploration Company Limited in 1974 permitted re-sampling by the company with the following results: Pb 0.18 percent, Zn 1.03 percent, Au trace, Ag 0.16 ounces per ton over 0.9 m (Moffat 1974).

VEIN NO. 3

Vein No. 3 located on claim 4722 at grid location 3400E, 440N (see Figure 11, "No.3 Zone") is about 90 m SE of vein system 5. A stockwork of barren appearing quartz veins, about 1.8 m wide in sheared felsic metavolcanics, was observed by the field party. Hopkins (1951, p.4) reported "low values" and minor galena and sphalerite.

However blasting and re-sampling by Noranda Exploration Company Limited in 1974 involving 10 channel samples over an average width of 2.0 m and a strike length of 26 m yielded an average of: Pb 1.13 percent, Zn 2.21 percent, Au trace, Ag 1.04 ounces per ton (Moffat 1974).

CANADA MINES SYNDICATE VEIN

The trenching on the Canada Mines syndicate vein is almost completely overgrown with saplings, moss and slumped overburden. It is located on claim 4725 (2191 on Map 2411) at grid location 1600E, 300N to 1200E, 400N (see Figure 11). It was described fully by Gledhill (1925, p.81,82).

> On claim KK 397, a wedge of sheared quartz porphyry was intruded among the Keewatin greenstone schists. Auriferous pyrite in quartz veins occurs near the contact of the porphyry with the greenstone. The quartz veins have been drag-folded and are not continuous. A sample of the more richly mineralized, auriferous, pyrite-bearing quartz, when assayed by the Provincial Assayer, gave $193.60 in gold per ton.
>
> Another vein filled with carbonates, galena, and sphalerite, and chalcopyrite extends east of the porphyry and the drag-folded quartz veins. These carbonate veins are not drag-folded, but are linear, having the same strike and dip as the enclosing greenstone schist. The greenstone schist dips north at 85° and strikes about N60°E. The carbonate gangue in this vein shows grey and white banding, and its rusty weathering in the outcrop is suggestive of the weathering of siderite, the iron carbonate. The gold and silver values are low in the carbonate veins.
>
> On KK 401, a sheared porphyry occurs in greenstone schists along with a vein consisting of quartz, pyrite, galena, and sphalerite. The better mineralized portion of the vein, which is rich in pyrite, galena, and sphalerite carries $2.20 in gold per ton and 14.9 ounces of silver per ton.
>
> In the present discovery, all the gold is contained in mineralized quartz veins which are not plentiful enough or continuous enough to be mined. Possibly a mineralized shear zone will be found on this property near the junction of the porphyry and greenstone. There is evidence for a replacement of the veins on KK 401.

Drill hole 21 (see Figure 11) put down by Coulee Lead and Zinc Mines Limited in 1947, failed to disclose significant gold mineralization (Regional Geologist's Files, Ontario Ministry of Natural Resource, Thunder Bay). Hopkins (1951, p.4) reported that some of the pits east of the above gold showing were cleared out in 1937 and assays of $1.05 gold per ton (gold at $35 per ounce) and 3 ounces silver per ton were obtained. Drill holes 19 and 20 of Coulee Lead and Zinc Mines Limited intersected this zone in 1949 and yielded only "low" gold and silver (Hopkins 1951).

VEIN NO. 7

No. 7 vein is located on the east-central part of claim 4731 (2193 on Map 2411) at grid location L0, 180S (see Figure 11). The vein is exposed in a trench about 20 m long by about 2.5 m wide trending about N45E. The hanging wall of the vein system is chloritoid-sericite schist and the foot wall is carbonatized rhyolite with pyrite along fine (2-3 mm) cracks. The 0.6 m of rock south of the mineralized zone consists of fractured, sheared rhyolite with up to 10 percent disseminated pyrite. The rhyolite strikes N58E and dips 73N. A zone of porphyritic carbonatized rhyolite contains 0.3-1.2 m wide quartz-filled shear zones containing massive to 80 percent disseminated pyrite. The west wall of the trench has a 2.5-5 cm wide zone with two or three 1 cm wide stringers of quartz and galena. An assay (Geoscience Laboratories, Ontario Geological Survey) of a grab sample taken by the author yielded 0.12 ounces per ton Au, 17.84 ounces per ton Ag, 0.15 percent Cu, 3.50 percent Pb, and 0.59 percent Zn. A grab sam-

ple taken by the author from a 1 cm wide quartz and galena filled shear a few centimetres away yielded 0.01 ounce per ton Au and traces of Ag, Cu, Pb and Zn. A sample of an 45 cm wide gossan zone in the same trench yielded 0.01 ounces per ton Au, 0.77 ounce per ton Ag, 0.02 percent Cu, 0.14 percent Pb and 0.08 percent Zn. This zone has not been drilled. An average of 10 channel samples across the width of the trench (Figure 12) taken by personnel of Noranda Exploration Company Limited yielded: Pb 0.05 percent, Zn 0.16 percent, Au trace, Ag 0.26 ounces per ton (Moffat 1974).

JOHNSON GOLD TELLURIDE VEIN

This vein is located on claim 4770. The vein was described by Hopkins (1951, p.4) as about 20 m long (strike and dip unknown) and 2.5 cm thick in mafic metavolcanics. It consists of quartz with gold and gold tellurides in "minute fractures extending at low angles into the wall rock for about an inch from the main fracture". Some pyrite, and a little pyrrhotite and traces of chalcopyrite are also present. "Disappointingly low" values were reported from drilling of six X-ray holes in 1937 (Hopkins 1951). The vein could not be located by the field party.

"COPPER" ZONE

This zone, named by Tyson (1949, p.26), occurs on claim 4770 (see Figure 11) and is described by him as follows:

> Close to the mid point of the west boundary of KK 4770 and about 300 feet east of the diamond drill road, and an old root house, there is an old trench across a sulphide zone. The mineralization is pyrite, pyrrhotite and a little chalcopyrite. A long prospect hole, No. 18, was put down under this showing but yielded no values in gold, silver, lead, zinc or nickel. The best copper assay was 0.42 percent. One sample of core assayed 0.04 platinum.

Drilling by McIntyre Porcupine Mines Limited on the Copper Zone in 1952 was designed to extend zone 5 and to test most of the other zones. The option was dropped after 1952.

The showing was not found in the course of mapping by the field party or crews of Noranda Exploration Company Limited.

NORANDA EXPLORATION COMPANY LIMITED

The properties of Headway Red Lake Gold Mines Limited, and Coulee Lead and Zinc Mines Limited comprising claim numbers: Headway Red Lake Gold Mines Limited 2422-2424, 28845, 4730, Coulee Lead and Zinc Mines Limited 2189-2193, 2640, 2809-2811, 4719-4721, 4724, 4727, 4770, 4771, 4773-4777, 4976-4979, 5018, and 5570 were optioned by Noranda Exploration Company Limited in June 1971.

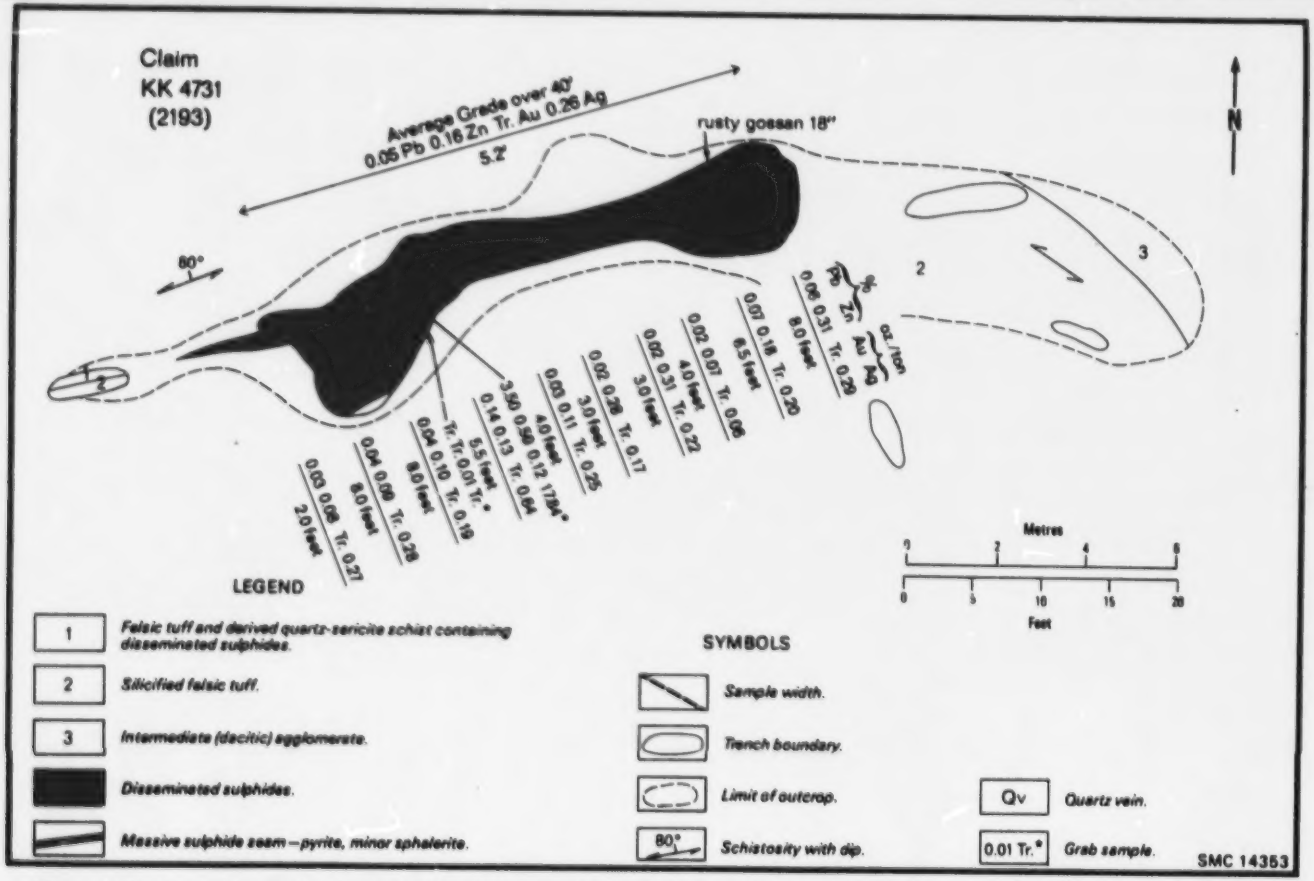

Figure 12–Geology and assay plan, Coulee Lead and Zinc Mines Limited No. 7 Zone (Noranda Exploration Company Limited option). After Moffat (1974).

TABLE 5 DIAMOND DRILL RESULTS BY NORANDA EXPLORATION COMPANY LIMITED ON COULEE LEAD AND ZINC MINES LIMITED OPTION.

Hole No.	Grid Location (feet)	Length	Conductor
72-4	400N 8400E	91 m	chlorite schist, disseminated pyrite, pyrrhotite.
72-5	2300N 6000E	88 m	graphitic schist, pyrite.
72-6	1150S 9100E	87 m	gabbro, disseminated pyrite, pyrrhotite.

Following option of the above claims, personnel of Noranda Exploration Company Limited staked 25 claims shown as the 302 645-302 669 series on Figure 11. Following geological and geophysical work in late summer 1971 the 304000 series of claims totalling 34 claims were staked to protect a pyrite, pyrrhotite, chalcopyrite showing at the mafic metavolcanic-granite contact to the north of the optioned ground. An additional 17 claims of the 304000 series were staked in 1972.

The company did a geological survey, ground magnetic survey and two types of ground electromagnetic surveys (JEM and Crone vertical loop). In addition it is known that some soil geochemical work was carried out. This work was concentrated on the claims of the optionees, and resulted in a total of 10 diamond drill holes being drilled principally to check geophysical anomalies. Five holes (No.72-2,3,4 and I.P. 74-1) totalling 267.3 m were drilled on the claims of Coulee Lead and Zinc Mines Limited. However, it should be noted that none of the Noranda drilling tested either anomalies from the 1952 McPhar geophysical survey or many of the surface showings thus far described or the mineralized zones developed by Headway Red Lake Gold Mines Limited or Coulee Lead and Zinc Mines Limited except the Coulee No. 5 vein system.

The drill results are summarized in Table 5.

Further work by Noranda in summer 1974 consisted of re-blasting the trenches and pits of the Headway Red Lake Gold Mines Limited claims, an induced polarization survey, a very low frequency electromagnetic survey and drilling of nine diamond drill holes is discussed in the section dealing with the holdings of Headway Red Lake Gold Mines Limited.

WILLIAM CRANSTON [1949] (3)

William Cranston is listed as the owner of nine claims numbered 5513-5520 inclusive (centred on the Onaman River) by Hopkins (1949) (see Figure 9). The claim area is dominantly underlain by mafic metavolcanics. No assessment work is on file. The area was in part re-staked by Noranda Exploration Company Limited as part of their 304000 series of claims.

ELITE COBALT MINES LIMITED [1967] (4)

This company performed a magnetometer survey on a group of 29 claims located east of the Tashota-Nipigon Mines Limited property in 1967. The claim numbers were 27914, 27916-27918, 27921-27926, 27930-27942, 27945, 27947-27950, and 27953. No further work is on file for this firm. The claim area is underlain by mafic metavolcanics and granitic rocks. No pits or other workings were found during the present survey.

GERABOY SYNDICATE [1949] (5)

The Geraboy prospecting syndicate is listed as the owner in 1949 of group of 11 claims consisting of 5048-5050, 5479-5483 and 5509-5511 inclusive on a map accompanying Hopkins 1951 report (see Figure 9). The claims lie west of the Headway Red Lake Gold Mines Limited ground and are underlain principally by mafic metavolcanics. The claims have since lapsed. No assessment work is on file.

O. GREY [1949] (6)

The map accompanying Hopkins report (1951) lists O. Grey as owner of claims 5476, 5477 and 6478, which have since reverted to the Crown (see Figure 9). They were located north of the Hopkins group and northwest of the Tashota-Nipigon Mines Limited group. No assessment work is on file. The area is underlain dominantly by mafic metavolcanics.

HEADWAY RED LAKE GOLD MINES LIMITED (HEADVUE MINES LIMITED) (7)

The early history of the general area is as detailed for Coulee Lead and Zinc Mines Limited. On the west side of the Nipigon Forest Reserve five claims were staked in the early 1920s but lapsed due to low gold values. They were restaked at various times by T. Johnson, P.E. Hopkins, R. Barnum and others (Hopkins 1951).

Although it is unclear from Hopkin's report it would appear that part of the Headway ground was acquired, prior to June 1951 by staking and purchase from Coulee Lead and Zinc Mines Limited (Hopkins 1951, p.4).

The claims were numbered as follows: five leased claims 28845, 2422-2424, and 4730 and staked claims 4796-4799, 4800, 4802-4504, and 4774, 4775, and 4013, 4003-4007, 5042, 5077 and 5234 prior to December 1950 for a total of 24 claims. Base metal showings were found by Messrs Conway and Stokes in 1949-1950, and in January 1951 an electromagnetic survey was conducted by McPhar Geophysics Limited on the central section of the property. Fifty-five diamond drill holes comprising 3246 m of drilling were completed during the

interval February to May 1951. The claims, after this date, were the property of a new company, Headvue Mines Limited. The latter firm followed up with about 9000 m of diamond drilling, a total of about 131 holes. As of 1968 (Hopkins 1968, p.4) the four claims remaining of the Headway zone were optioned to the Chub-Stuart Syndicate. Upon option to Noranda Exploration Company Limited, further work was carried out (see below) from 1971 to 1974.

Sometime in 1969 or early 1970 the four leased claims were transferred back to Headway Red Lake Gold Mines Limited. The charter of the company was cancelled in April 1975, and in January 1976 the claims were in the process of reverting to the Crown.

Mineral Deposits

The company held, at the time of writing, leased claims 28845 and 2422-2424, located just east of MacDonald Lake (see Figure 11). These claims are underlain mainly by felsic metavolcanics. These consist of rhyolitic crystal tuff and finely banded tuff. Disseminated pyrite, galena, sphalerite and very rarely silver and cobalt minerals occur in the tuffaceous rocks as small fracture-filling masses up to 2-6 mm, or as isolated disseminated grains about 1 mm in size. There are some concentrations of sulphide minerals along small carbonate-epidote-sericite filled shears in the tuffaceous rocks.

MAIN ZONE

The "Main Zone" of Hopkins (1951), is a zone of mild to intense shearing in felsic tuff which occurs over an average width of 150 m and a total length of 420 m. The zone has an approximately vertical dip and on the basis of the longitudinal section (Hopkins 1951), a plunge to the southwest of about 45 degrees. The "main zone" was subdivided into A and B " oreshoots" by Hopkins (1951).

A ZONE

The A zone (formerly A oreshoot, Hopkins 1951) projected to surface vertically extends from 2400W on the Noranda Exploration Company Limited grid (see Figure 11), southwest to 4400W, a distance of 370 m along strike. The mineralized portion of the zone averages 150 m in width and 290 m in length according to Hopkins (1951, p.7).

The zone has been intersected by about 45 diamond drill holes which indicate an average width of mineralization of 2.7 m (Hopkins 1951, p.7). Samples picked at random by the author from drill core indicated two modes of occurrence: 1) massive pyrite occuring interstitial to pyroclastic fragments in tuffaceous rocks, with minor amounts of sphalerite and galena associated with the pyrite, and 2) disseminated galena and sphalerite in sheared chloritoid-sericite schist and sheared felsic tuff. Hopkins (1951, p.7) indicated an average grade

TABLE 6 ASSAYS BY NORANDA EXPLORATION COMPANY LIMITED OF SAMPLES FROM TRENCHES ON HEADWAY RED LAKE GOLD MINES LIMITED "MAIN ZONE". AFTER MOFFAT (1974).

	Width (feet)	Length (feet)	Pb %	Zn %	Au oz/ton	Ag oz/ton
Main Zone N Trench	4.3	20	2.93	1.24	tr.	4.56
Main Zone N Trench	4.8	57	1.60	1.17	tr.	2.39
Main Zone Cross Trench	9.0	-	0.29	3.10	tr.	1.00
Main Zone West	3.6	65	0.79	0.56	tr.	1.74

for this zone of 4.6 percent Zn, 1.45 ounces per ton Ag and combined Pb and Au at $1.00 per ton. Hopkins (1951) calculated the size of the deposit by two sets of dimensions as follows:

(1) 230 feet deep by 8.9 feet wide by 950 feet long at 12 cubic feet per ton = 162,050 tons (147 000 tonnes).

Hopkins (1951) revised the figures based upon information from holes 69, 68 and 97. Hopkins calculated a new average width of 9.57 feet and, although not specifically mentioned, seemed to raise the length of the body to 1,116.5 feet giving

2) 230 feet deep by 9.57 feet wide by 1116.5 feet long at 12 cubic feet per ton = 204,800 tons (185 800 tonnes) "indicated ore" in shoot "A".

"Parallel oreshoots" (Hopkins 1951) gave an additional 39,600 tons (35 900 tonnes) of "possible ore" for a total of 244,400 tons (221 700 tonnes). Hopkins' grade figures are expressed in foot dollars based upon lead and zinc at 10 cents per pound, cobalt at $1.00 per pound, copper at 20 cents per pound, silver at $1.00 per ounce and gold at $35.00 per ounce, giving an average value of $10.977 per ton (Hopkins 1951).

Re-sampling of the surface showings (Table 6) was carried out by personnel of Noranda Exploration Company Limited in 1974. Sample locations are shown in Figure 13 (Chart A, back pocket) in a general way.

In addition Noranda Exploration carried out an induced polarization survey of the property and re-drilled the Coulee No. 5 vein system, Headway "A" and "B" zones (six holes) and diamond drilled an additional three holes to test favourable induced polarization anomalies.

In 1974 Noranda Exploration Company Limited drilled two diamond drill holes HA 74-6 and HA 74-7 beneath the Headway "A" zone totalling 338.9 m. Hole HA 74-6 intersected a 30.3 m mineralized section consisting of stringers of pyrite-sphalerite. Assays of 0.96 percent Pb, 2.42 percent Zn, trace Au, and 2.45 ounces per ton Ag over a 5.94 m section were reported by Moffat (1974). Hole HA 74-7, 30 m to the west, did not intersect the mineralized zone. The greater depth penetration of Noranda's hole 74-6 compared with the older drilling would suggest that greater tonnages are available, on the order of an additional 150,000 tons for a total of 356,163 tons (323 106 tonnes). Noranda's results (*in* Moffat 1974) in surface sampling and drilling would indicate a slightly lower grade than indicated by Hopkins (1951). Reconciliation of these differ-

ences is beyond the scope of this report, given the limited information available. Noranda Exploration Company Limited drilled another hole, (IP 74-9) located at 4800W, 900N, 90.5 m long.

B ZONE

B zone (see Figure 11, 2400W to 3000W) corresponds to Hopkins' "B oreshoot" and has a strike length, projected vertically to surface of 180 m and an average width of 1.2 m. Its strike is parallel to A Zone, but no longitudinal sections are available upon which to estimate plunge. Grades quoted by Hopkins (1951) are 4 percent Zn and 1 ounce Ag per ton. He calculated, in the same fashion as for A zone, but without any detail, a tonnage of 45,800 tons (41 500 tonnes) of "indicated ore" in B zone and in addition a further 10,000 tons (9100 tonnes) of "possible ore" in "C zone", the location of which is unknown to the author. Noranda Exploration Company Limited drilled one hole (HB 74-8, total length 87.5 m) to test the southwesterly extent of the B zone, encountering mineralization assaying over 3.0 m, as follows: Pb 0.69 percent, Zn 0.82 percent, Au trace, Ag 4.82 ounces per ton (Moffat 1974).

Summary, A and B Zones

Hopkins (1951) calculated a total tonnage for A and B zones of 250,000 tons with a weighted average value of $10.96 per ton (1951 prices) and a weighted average grade of 1.32 ounces per ton Ag and 4.44 percent Zn. In addition, he listed additional possible tonnage for the A zone of 39,600 tons and for the C zone 10,000 tons, but no grade was given for the latter two.

Hopkins (1951, p.12) concluded as follows:

> Because the orebodies are replacement deposits they will probable be characterised by the usual irregular shape with indefinite boundaries and hence must be drilled at close horizontal and vertical intervals.
>
> Due to the lenticular nature of the oreshoots and the many cross faults, underground development must take place before ore can definitely be proven as to grade and tonnage. Drilling is only a guide for underground work in these cases where it is justified.

The author would suggest that large tonnages are less likely in this environment relative to syngenetic bodies.

MIDDLETON VEIN

This vein occurs on claim 28845 at grid location 5800W, 1700S (see Figure 11). The vein was discovered in 1937 and described by Moorhouse (1938, p.18,19) as follows:

> The Middleton find, made in the summer of 1937, is located on claim T.B. 24,188, east of MacDonald Lake and south of the Onaman River.

The country rock consists of chlorite schists with a regional trend northeast and southwest. In the vicinity of the prospect, however, the direction of shearing is rather variable; and in the area, about 40 feet square, in which the mineralization is developed, the schist is so much contorted that it breaks up into slender prismatic slivers. Miniature drags also may be observed in the highly disturbed area. The zone is terminated at its west end by what appears to be a fault. The fault was marked by an actual opening into which powder could be shoved, for blasting, without preliminary drilling.

Silicification in the mineralized area took the form of quartz lenses up to 12 inches wide, milky white, and usually free from metallic mineral. The heavy sulphide appears to favour highly silicified schist rather than the quartz itself.

The chief metallic minerals are pyrite, galena, sphalerite, chalcopyrite, and argentite. In polished section, a mineral resembling tetrahedrite was observed. Gangue minerals include quartz, large white flakes of mica, greenish talc, chlorite, cream-coloured carbonate (which seems to be associated with the sphalerite), white carbonate; and feldspar. In places, galena and sphalerite are abundant.

It is reported that grab samples have yielded as much as 192 ounces of silver and a little gold. The values terminate at the fault and have not been traced in any direction beyond the circumscribed area mentioned, although the prospect has been almost encircled by trenching. The property is owned by T.A. Johnson and W. Middleton.

Tyson (1949, p.12) stated that the mineral resembling tetrahedrite is freiburgite. Resampling by Noranda Exploration Company Limited consisting of one sample of unknown type gave the following results: Pb trace, Zn 0.03 percent, Au trace, Ag 0.03 ounce per ton (Moffat 1974).

NORANDA EXPLORATION COMPANY LIMITED

As detailed above, the Headway property was optioned in conjunction with the Coulee Lead and Zinc Mines Limited property, to Noranda Exploration Company Limited in 1971. Geophysical and geochemical surveys were conducted, but no diamond drilling was carried out on the three optioned claims: 2422-2423, and 28845 in 1972 or 1973.

Noranda staked additional claims after optioning the Headway Red Lake Gold Mines Limited and Coulee Lead and Zinc Mines Limited claims. Geological and geophysical work as described above was carried out on the 302000 series claims. Additional work (personal communication, R. Woolverton, Noranda Exploration Company Limited, 1974) consisted of an airborne electromagnetic survey of a larger area which includes the ground under discussion. The survey was flown by Questor Surveys Limited in summer 1972. Previous to November 1972 a survey using the Scopas 80 VLF (very low frequency) EM unit was also undertaken in the area by Noranda. Follow up to this work consisted of diamond drilling as summarized in Table 7.

The 304000 series of claims was staked to cover disseminated pyrrhotite in fractured mafic metavolcanics north of the Onaman River. Occasional grains of chalcopyrite are found on joint surfaces. Several "pop-holes" were made in an outcrop 4.0 km west-southwest of the winter road bridge across the Onaman River, by Noranda personnel. A grab sample taken from the outcrop by the author's assistants shows scattered 1-2 mm grains of chalcopyrite on joint surfaces. Assays by the Geoscience Laboratories, Ontario Geological Survey, have indicated trace amounts of Cu. Assays by Noranda yielded assays of 0.06 per-

TABLE 7 DIAMOND DRILL RESULTS BY NORANDA EXPLORATION COMPANY LIMITED, ON HEADWAY RED LAKE GOLD MINES LIMITED OPTION.

Hole No.	Grid Location (Fig. 11) (feet)	Length	Conductor Description
72-1	1525N, 1600W	91m?	Graphitic schist.
72-2	2550S, 2000W	91m	Pyrite, pyrrhotite.
72-3	890S, 8100W	91m	Massive Pyrite, pyrrhotite in rhyolite.
72-7	1640S, 8515W	95m?	Rhyolite with pyrite, pyrrhotite.
72-8	0, 650W	84m?	Pyrite, pyrrhotite in chlorite schist.
72-9	680S, 2845W	91m	Mafic tuff, pyrite, pyrrhotite trace chalcopyrite.
773-1	1650S, 2640E		Dacite, pyrite, pyrrhotite.

cent Cu, trace Ag, 0.07 percent Zn, and trace Pb (Personal Communication, 1974, R. Woolverton).

A.P. HOPKINS (8)

According to the Canadian Mines Handbook (1956) Gulf Lead Mines Limited held an option on eight patented claims 2272-2275 and 2238, 2239, 2242 and 442. A map in the author's files lists claim 2239 as the location of the "Currie Vein", believed identical to that described as the Currie claim, KK514, by Gledhill (1925, p.83) whose description follows.

Currie Claim K.K. 514 — This discovery was made in August, 1923, and was of interest because of the finding of a rich galena, sphalerite, pyrite vein. The break is in Keewatin greenstone and trends in a northeast direction across the claim. At the east end the vein is very narrow and has a little rusty quartz carrying a few specks of galena. T. Currie by careful prospecting followed the break westward and found that it widened in this direction. The break contains a feldspar-porphyry dike similar to that on K.K. 514....

There is some evidence that this vein is a replacement of a pyrite lens in the Keewatin rocks, the galena replacing the pyrite. The pyrite appears in the galena as rounded blebs, which lends support to the replacement theory.... This ore is of special interest on account of its content of both gold and silver, the silver running as high as 40 ounces per ton and the gold from $5 to $6 per ton.

The distance between claims K.K. 514 and 524 marks the width of the chief mineralized zone in this part of the camp.

No assessment work is on file for this claim group which is underlain by mafic metavolcanics and iron formation marking the westward extension of the property of Tashota-Nipigon Mines Limited. The claims are presently held by Hopkins and are in good standing.

KATERI MINING COMPANY LIMITED [1952] (9)

Kateri Mining Company Limited acquired by staking a group of 20 claims numbered 22429-22448 and by option four numbered 22340-22343. These were located immediately north and east of the Tashota-Nipigon Mines Limited property. Using an electromagnetic survey conducted in 1952 by P.E. Hopkins, they elected to drill two holes totalling 654.7 m (Regional Geologist's Files, Ontario Ministry of Natural Resources). No assays are given and drill collar locations and core were not found by this survey. Most of the anomalies detected by the electromagnetic survey were due to either graphitic metasediments and/or pyrrhotite in minor amounts, primarily associated with sheared mafic metavolcanics. No further work was recorded and the ground reverted to the Crown.

LYNX-CANADA EXPLORATIONS LIMITED — DEJOUR MINES LIMITED — CANADIAN REYNOLDS METALS COMPANY LIMITED (10)

A syndicate, comprised as follows: Lynx-Canada Explorations Limited, 37.5 percent; Dejour Mines Limited, 37.5 percent; Canadian Reynolds Metals Company Limited, 25 percent; optioned a group of 23 leased claims in July 1975 from Headway Red Lake Gold Mines Limited. A group of 54 claims was staked for the syndicate by D. Thorsteinson and N. Cox, under a grubstake arrangement. The second group of claims lies to the south and west of the leased claims of Headway Red Lake Gold Mines Limited.

Prospecting by Thorsteinson and Cox, based upon tracing an occurrence of malachite-cemented drift noted by personnel of Noranda Exploration Company Limited, resulted in further finds of sulphide float, and was followed by basal till geochemistry, a surficial geology survey, and a program of approximately 20 diamond drill holes as of January 1976. The drilling has indicated a mineralized zone, showing No. 1, shown as number 10, south of MacDonald Creek, on the map. The zone, which does not outcrop, appears on the basis of a cursory examination of the diamond drill core to be intermediate to mafic tuff and mafic flows. The zone strikes N70W, dips 80S and is about 60 m long and 3-6 m wide. The zone extends to a depth of 150 m and has a plunge of 55NW (personal communication, D. Thorsteinson, 1975). The amount of drilling done is probably not sufficient to use the plunge data with great confidence however. The zone appears to be stratabound in that it is consistently bounded by intermediate to mafic tuff on one side (footwall), and is closely associated with a brecciated carbonate unit which is very similar to the Woman Lake marble (Pryslak 1972) and could well represent sedimentary carbonate. The sulphides consist of chalcopyrite and pyrrhotite, but little if any pyrite is apparent. The sulphide minerals appear massive, and no structures resembling bedding or framboids were apparent in the core. Assay data and core width are given in Table 8. Figure 14 shows drill hole locations (after The Northern Miner, 23 Oct., 1975) and the location of the original float. Tonnage is estimated by the author to be about 70 000 tonnes on the basis of the available data. If more tonnage is found this deposit may be economic for a small scale operation.

TABLE 8 | ASSAYS OF DRILL CORE FROM NO.1 SHOWING OF LYNX-CANADA EXPLORATIONS LTD.-DEJOUR MINES LTD.-CANADIAN REYNOLDS METALS CO. LTD. AFTER THE NORTHERN MINER (1975) (DATES GIVEN UNDER REF.).

Hole No.	Core Width in feet	% Cu	oz/ton Ag	oz/ton Au	Ref.
7	7.3	1.35	1.09	—	9/4
	8.2	1.50	0.90	—	
8	8.6	2.04	1.97	0.03	9/48
9	22.1	3.07	2.40	0.045	9/25
10	11.0	1.37	1.17	—	10/2
11	7.3	0.63	0.72	—	10/2
12	16.5	0.52	0.48	—	10/2
13	18.1	5.38	4.55	0.29	10/2
14	9.9	6.97	4.37	0.036	10/9
15	21.0	"low grade mineralization"			
16	5.7	1.50	1.00	0.02	
17	15.9	0.45	0.49	—	11/13
18	13.9	3.86	3.03	0.06	10/30
19	22.6	3.20	3.05	0.06	
20	19.6	0.82	1.35	0.01	
21	16.4	3.01	2.48	0.08	

The Northern Miner reported on October 23, 1975 that a second area of mineralization had been found on surface. The No. 2 showing lies 200 m north of MacDonald Creek and 30 m east of the Tashota Mine road. The zone consists of a series of mineralized, brecciated quartz veins in mafic flows. The author briefly examined the series of trenches (Figure 15). Most of the area in the sketch is outcrop, but as the outcrop was partially covered with frozen mud and ice it was impossible to ascertain how continuous the various veins are. The zone strikes at about N70W and dips essentially vertically. Geophysical results indicate that the zone has a lateral extent of about 90 m to the northwest (personal communication, D. Thorsteinson). Trench No.1, the largest on Figure 15, exposes a maximum of 1.2 m of quartz vein which is probably continuous over the length of the trench (partially obscured by water and ice). Trenches No.4, 3, 2, and 6 disclose a possibly continuous quartz vein varying in width (including

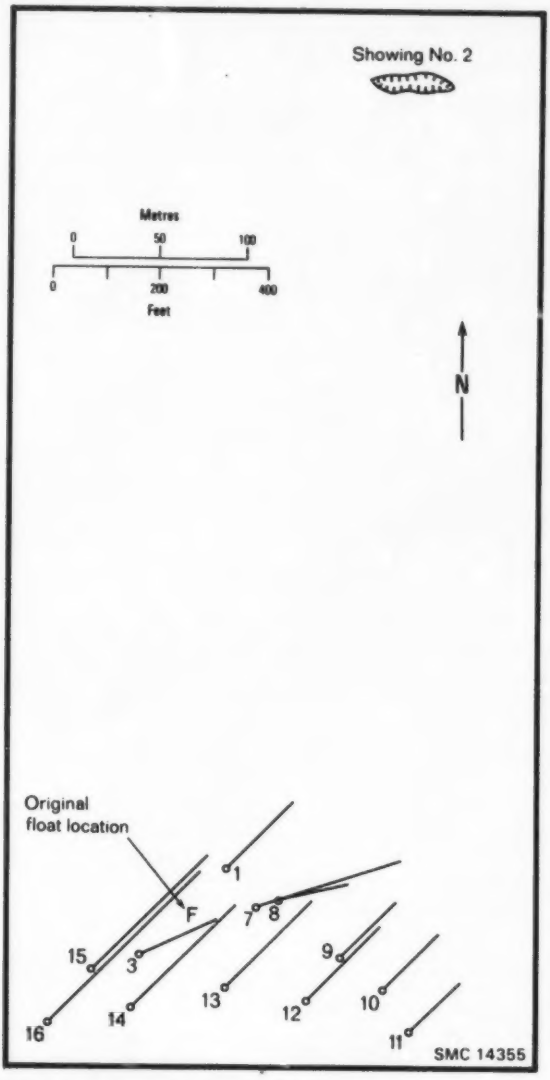

Figure 14–Location of diamond drill holes on No. 1 showing of Lynx-Canada Explorations Limited, Dejour Mines Limited, and Canadian Reynolds Metals Company Limited. The showings are indicated on Map 2411 as property 10. No. 1 showing is about 270 m south of MacDonald Creek and No. 2 is about 200 m north of the creek. The road to the Tashota mine lies about 30 m to the northeast.

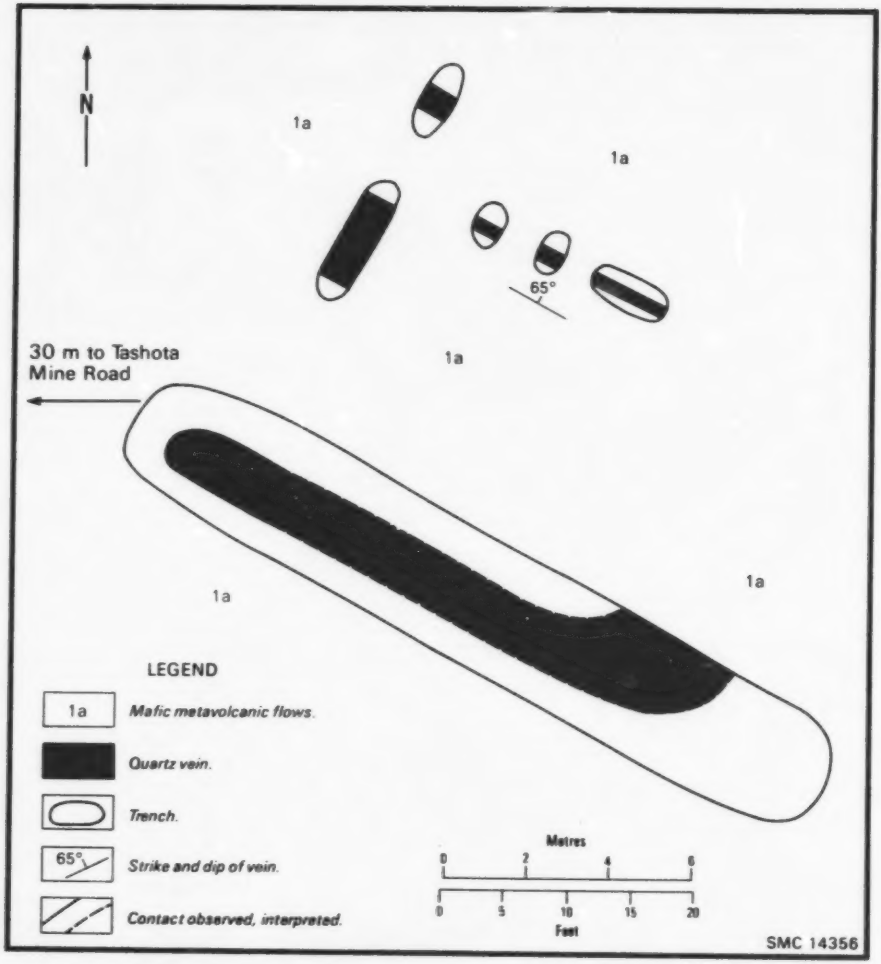

Figure 15–Geological sketch map of No. 2 showing on property of Lynx-Canada Explorations Limited, Dejour Mines Limited, and Canadian Reynolds Metals Company Limited. No. 2 showing is about 200 m north of MacDonald Creek.

TABLE 9 | ASSAYS OF DRILL CORE FROM NO. 2 SHOWING OF LYNX-CANADA EXPLORATIONS LTD.-DEJOUR MINES LTD.-CANADIAN REYNOLDS METALS CO. LTD. AFTER THE NORTHERN MINER (DEC. 11, 1975).

Hole No.	Location	Core width of mineralization	% Cu	Ag oz/ton	Au oz/ton
22	100′ west of surf. trench	25.3	1.10	0.59	TR
23	under trench	44.3	0.92	0.38	0.05
24	80′ behind, 20′ west of 22	10.5	5.20	2.08	0.02
24	80′ behind, 20′ west of 22	7.1	2.93	1.86	0.01
25	80′W of No.22	6.4	6.71	2.48	0.04
26	100′W of No.22	72.6	0.50	0.19	TR

zone wall-rock material) from 0.3 m to 2.3 m. Trench No.5 exposes a 0.6 m thickness of quartz vein. The veins are fairly uniformly mineralized with 5-10 percent chalcopyrite and minor pyrrhotite. Up to 2 percent chalcopyrite occurs as disseminations in the surrounding schistose mafic flows. Assays of grab samples taken by the author from vein material at this showing location are as follows:

Sample No.	Gold (oz./ton)	Silver (oz./ton)	Copper (percent)
2	0.05	3.49	5.77
3	0.08	0.92	4.59
5	0.07	0.95	1.81

(Assays by Geoscience Laboratories, Ontario Geological Survey)

Drilling of this showing is summarized in Table 9 (The Northern Miner, Dec. 11, 1975, p.7).

The No. 1 showing, based on the massive nature of the sulphides, the consistent stratigraphic relationship to the mafic tuffs and the marble(?) unit, appears to be a syngenetic deposit of the Maybrun mine or Coronation mine type (Davies 1973; Froese 1969). In addition, the fact that it is a Cu-Ag-Au occurrence rather than the Cu-Zn-Ag type associated with felsic volcanism would tend to bear this suggestion out.

However the No. 2 showing is probably a remobilized syngenetic deposit associated with the surrounding mafic flows. The trend of the mineralized zone is similar to that of the Cu-rich zone at the Tashota mine and would suggest that the mechanism of emplacement of the quartz veins and sulphide mineralization may be similar. Given this sort of origin, careful examination of geophysical anomalies associated with the iron formations in the vicinity is warranted as they may be the locus of the undisturbed mineralization (i.e. syngenetic).

I. MCDONOUGH [1949] (11)

Ivan McDonough was listed as owner of claims 5051-5053 on a map accompanying A. Hopkins (1949) report. The claims if correctly plotted are underlain by the mafic metavolcanics. No assessment work is on file. Additional claims appear to have been owned by McDonough based on the data in Figure 9. No claim numbers are available. This ground was re-staked in 1971-1972 as part of the 304000 series of Noranda Exploration Company Limited.

J. MOSSO [1949] (12)

John Mosso was listed in A. Hopkins (1949) report as the owner of nine claims, 5561-5569 inclusive, northeast of Pauloski Lake. The ground is underlain by mafic metavolcanics. No exploration work has been recorded in the assessment files. At the time of the survey the ground was open for staking.

PAULOSKI OCCURRENCE (13)

William Pauloski was listed in Hopkins (1949) report as the owner of a group of 12 claims numbered 5495-5506 inclusive. The claims are underlain by mafic metavolcanics. No assessment work is on file. The claims have reverted to the Crown.

Moorhouse (1938, p.19) listed Pauloski as the owner of at least one claim, 2573 "on the winter road leading west from the property of Tashota Goldfields, 45 chains east of the east boundary of the Nipigon Provincial Forest". It was described by him as:

> A series of quartz lenses and silicified shear zones in greenstone and a sheared, light-weathering, porphyritic rock, probably altered greenstone.
>
> The shear zone strikes N82°E, and has been traced for about 300 feet. The maximum width of any one quartz lens is about 18 inches. The dip appears to be north.
>
> The quartz is milky and well fractured, and carries pyrite as cubes and splashes. Galena occurs as masses and stringers in chloritic inclusions in the quartz and in the country rock. Irregular cubes of pyrite occur in the galena. A polished section in the massive galena revealed the presence of sphalerite as well as galena and pyrite. Values in gold and silver are reported, but the small size of the deposit prohibited further work.

The shear zone described by Moorhouse was not located by the field party.

This latter description is assumed to refer to the same area as listed by Hopkins under different claim numbers. The ground was open for staking at the time of the present survey.

ROUANDAH OCCURRENCE (14)

Rouandah Oils and Metals Limited acquired by option from a Mr. Lee a group of nine claims numbered 5521-5529. The claims lie between the Onaman River and the Tashota mine. The claims are listed on the map accompanying A. Hopkins (1949) reports as those of R.A. Coutts (Figure 9).

A magnetometer survey was carried out in 1951, followed by the drilling of two diamond drill holes totalling 458.1 m. Hole R-1 dipping 45S encountered 0.8 m of 95 percent pyrrhotite with assays quoted as Au trace, Ag trace, and Cu 0.08 percent (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). Hole R-2 at a dip of 45SE intersected 0.8 m of sheared mafic metavolcanics which assayed trace Au, Ag, and "rich" Cu. Both holes penetrated predominantly mafic metavolcanics.

The company also optioned "Lee group No.2" (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay) consisting of nine claims 5530-5538 lying north of the Coulee Lead and Zinc Mines Limited property. A ground magnetometer survey was carried out on this claim group in 1951.

Neither drill collar locations, drill core nor workings were found in the course of the present mapping. The property, if correctly located by Hopkins' map (1949) is underlain by mafic metavolcanics. The Coutts claim area was open for staking at the time of this survey. The Lee claim area was covered by the Noranda Exploration Company Limited 302000, and 304000 series claims in 1974.

TASHOTA-NIPIGON MINES LIMITED (TASHOTA GOLDFIELDS LIMITED) (15)

The property consists of 10 patented claims 522-526, 536-537, 562, 563, 565 owned by Tashota-Nipigon Mines Limited. The property is located at the end of the old mine access road northwest of Onaman Lake.

In August 1923, J. McKechnie discovered visible gold on claim 524 near the south boundary in "sheared greenstone" (Gledhill 1925, p.83) In 1924, the property was optioned to the Nipissing Mining Company. No development work is known to have been done by this firm (Moorhouse 1938, p.21).

Tashota Gold Mines Limited was formed in 1927 in part to develop the property which then consisted of six claims: 522-526 and 536. Surface stripping and test pitting was done in fall 1927. A mining plant was taken in via the winter road from Tashota that winter. By August 1928, a 68 m, two compartment shaft was sunk, with levels at 30 and 60 m (Sutherland *et al.* 1928, p.145). Minor development work was done by this time. Two claims, 537 and 562, were added by July 1929. Underground operations ceased in February 1929 and a surface drilling program totalling 880 m had been completed by July 1929 (Sinclair *et al.* 1929, p.147). Work underground was resumed in September 1929 with 165 m of drifting and crosscutting and a total of 1610 m of diamond drilling (Sinclair *et al.* 1930, p.125). Work ceased in March 1930 (Sinclair *et al.* 1931, p.95), and resumed from September 1931 to March 1932 (Sinclair *et al.* 1932, p.89). Tashota Goldfields Limited was incorporated on November 15,

TABLE 10 PRODUCTION AT THE TASHOTA GOLDFIELDS LIMITED MINE.

	Au Ozs.	Ag Ozs.	Cu lbs.
1935	2 157.326	1 071	155 687
1936	6 310.912	6 710	215 124
1937	3 437.354	5 997	182 514
1938	450.000	749	22 105
Totals	12 355.592	14 527	575 430

Data from Ontario Dept. Mines Annual Reports for the above years.

1932 (Sinclair *et al.* 1933, p.43) and this company resumed work in April 1934 with shaft sinking to 112 m and a third level established at the 99 m horizon. Three patented claims were added before 1935, making a total of nine patented claims. In early 1935 a 50-75 ton mill was installed, and production is listed in Table 10. A tenth patented claim was added in 1936. In 1937, a three-compartment shaft, inclined at 70 degrees, was put down to the west of the old workings. A two-compartment winze, inclined at 70 degrees was put down in 1937 from the 99 m level to a total depth of 396 m, with levels at 145 and 191 m (see Figure 18). Operations ceased in October 1937.

In 1967 International Mine Services Limited de-watered the mine for Tashota-Nipigon Mines Limited and did 1220 m of diamond drilling, a limited amount of underground mapping and a surface geological map at a scale of 1 inch to 40 feet (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay).

General Geology

The property is underlain (Figure 16) by pillowed, porphyritic and massive mafic metavolcanics (grain size 1-3 mm) which are gradational into rocks termed "diorite" by Tindale (1967, p.5). The dioritic rocks are coarser grained (up to 5 mm) massive rocks with frequent intercalations of chlorite schist. On the basis of their relationship to the granitic rocks to the south near the "west showing" the author believes that they probably represent a coarse-grained synorogenic intrusion. To the north the metavolcanics are overlain by Algoma type (Gross 1965) oxide and sulphide facies iron formation. The iron formation extends the full length of the property, at least 600 m, and is a maximum of 25 m thick, where not thickened by deformation. To the north of the iron formation is an irregular, semiconcordant body of gabbro about 90 m thick, extending at least 600 m east-west. This rock type was thought to be intrusive into the volcanic pile by Tindale (1967, p.5) on the basis of xenoliths of iron formation found within it. Numerous porphyry dikes cut all the above units. Their extent is uncertain as they cannot be traced from outcrop to outcrop.

Most of the rock types are sheared, and fault breccia and chlorite schist are common on the property. The porphyry dikes include quartz, quartz-feldspar and feldspar porphyry. According to Kindle (1931, p.91) the dikes are highly sheared toward their margins. Flaherty (1936, p.730) showed an intrusive porphyry body associated with a synclinal fold which is exposed in the 60 m level but does not outcrop at surface. In addition an intrusive diorite/gabbro occurs south of the mine workings.

Structure

The iron formation, chloritic horizons in the mafic metavolcanics, and the dioritic unit south of the shaft form excellent marker horizons to trace structural features. The markers serve to delineate minor secondary folds (Figure 16) consisting of a syncline plunging 55-60 degrees northwest, the trough of which is occupied by the gabbro southeast of the shaft, succeeded to the northeast by a northwest-plunging anticline indicated by strikes and dips on surface and according to Flaherty (1936, p.729) by an anticlinal nose defined by a chloritic horizon in the mafic metavolcanics. He ascribed the formation of the secondary folds to "a shearing stress or couple acting at small angle to the general or regional strike, or at least the effective component of this couple acted in this direction". Movement was north side west and included a vertical component, resulting in north side upward movement.

Two sets of "shear joints" were described by Flaherty (1936, p.731, 732). As that level of detail was not possible on this survey, his description is summarized herewith. The major set[1], (termed B by Flaherty) with an orientation of about N20E and dipping 65-80 degrees west and S70W dipping 65-75 degrees north is a set of complementary shears symmetrically placed about the axis of the minor folding, and is due to the compressional forces which produced the fold. This set[2] of shear planes strikes parallel to the axial plane and dips less steeply than the axial plane, the two sets being approximately perpendicular. The secondary set (A of Flaherty) has an orientation of N20W dipping 80-90 degrees east and S70W dipping 65-75 degrees south. This second set was brought about by a shear couple acting parallel to the axis of the fold, producing so-called tension joints. Movements on the main, east-west shear zones parallels the assumed direction of the shear couple which produced the mineralised zones.

The mineralised zones consist of quartz- and sulphide-filled shear zones, generally bearing a close spatial relationship to the intrusive diorite and porphyry bodies. The zones plunge parallel to the plunge of the secondary folds at 55-60 degrees to the northwest.

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[1] *Set* here refers to a statistically defined maximum on a beta plot.
[2] *Set* here refers to movement on two joints brought about by the same stress field.

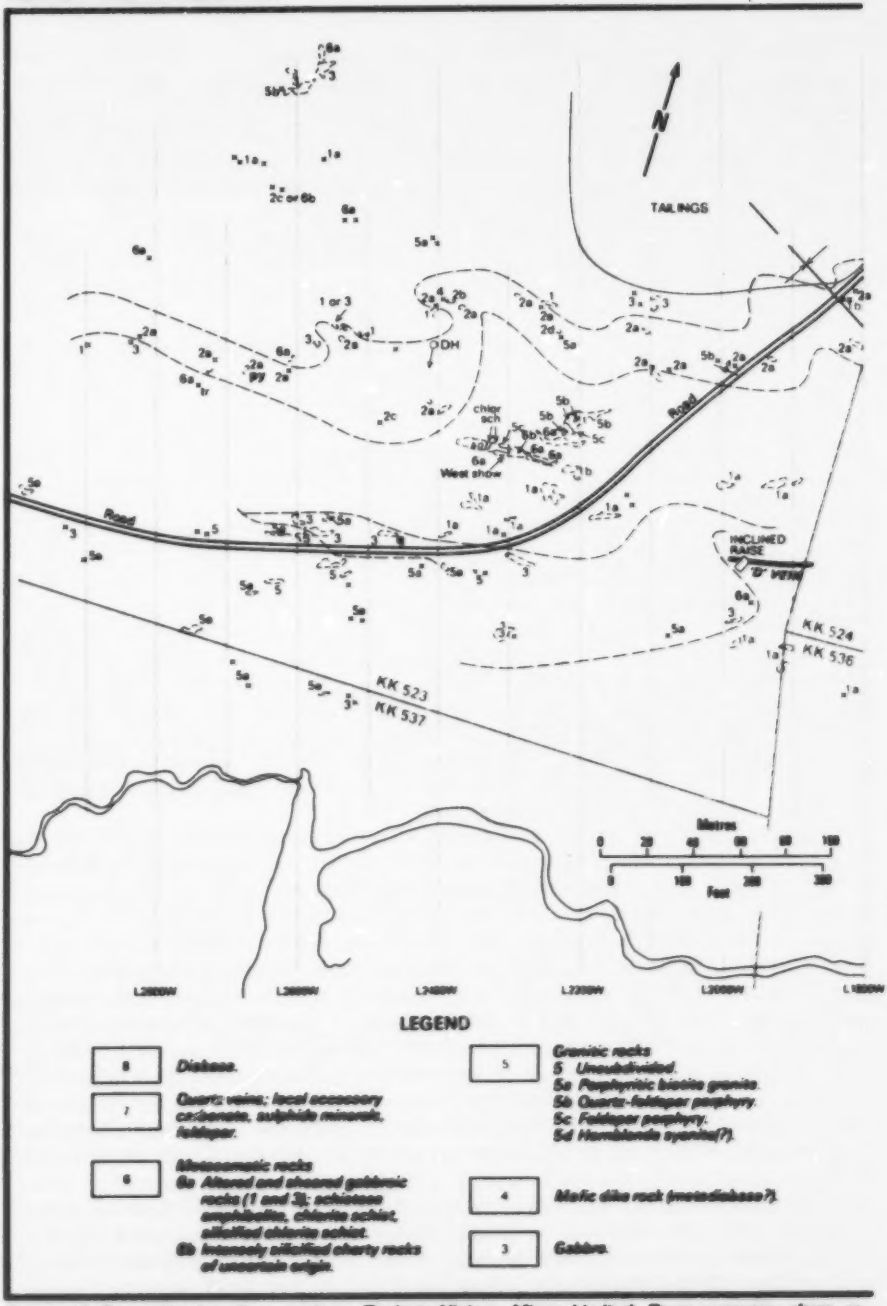
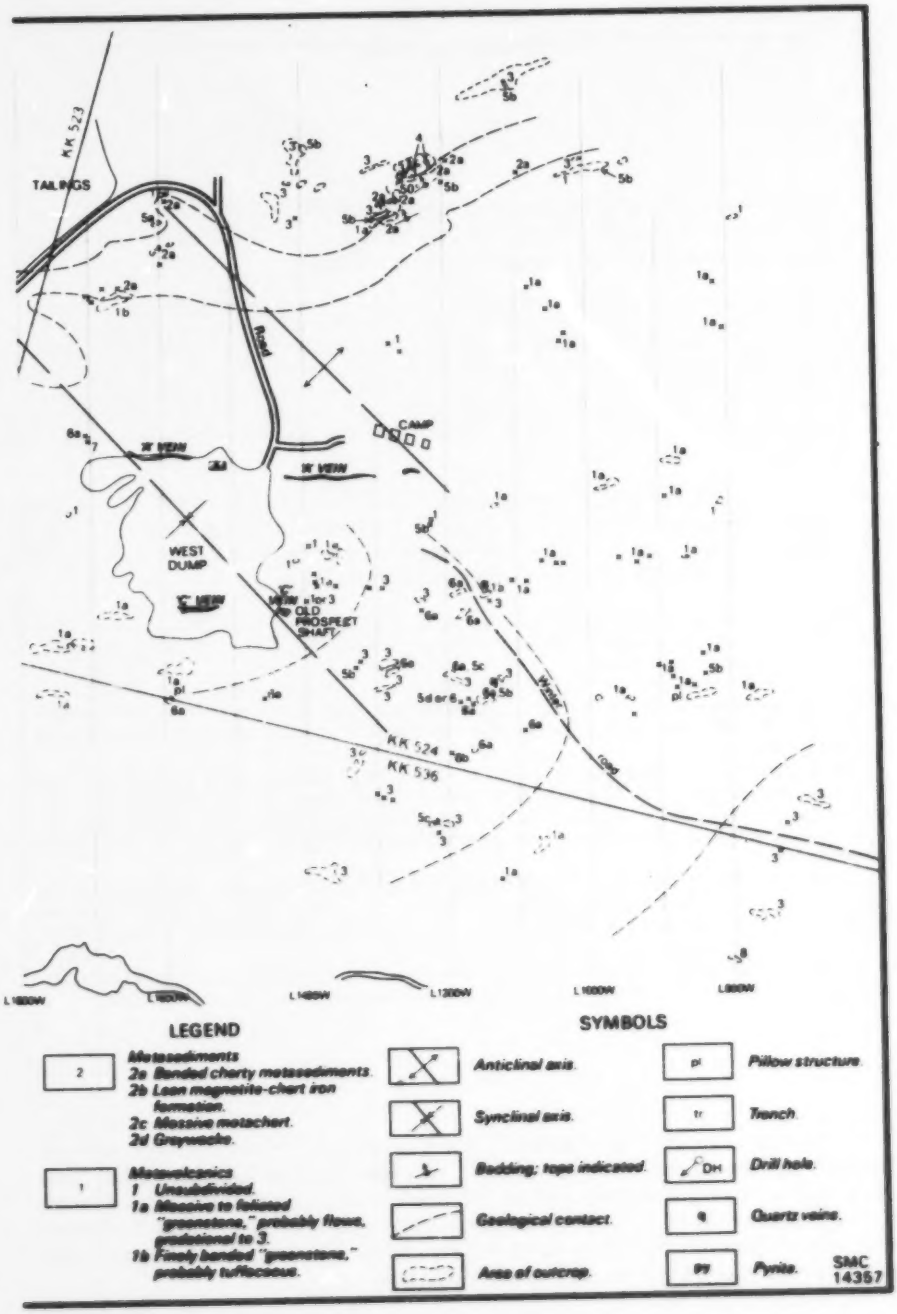


Figure 18–Generalized surface geology, Tashota-Hipgon Mines Limited. From company plans ca. 1957-1958.


KK 523
TAILINGS
Road
CAMP
W VEIN
W VEIN
WEST DUMP
E VEIN
OLD PROSPECT SHAFT
KK 524
KK 536
L1600W
L1400W
L1200W
L1000W
L800W
LEGEND
SYMBOLS
Metasediments
2a Banded cherty metasediments.
2b Lean magnetite-chert iron formation.
2c Massive metachert.
2d Greywacke.
Metavolcanics
1 Unsubdivided.
1a Massive to foliated "greenstone," probably flows, gradational to 3.
1b Finely banded "greenstone," probably tuffaceous.
Anticlinal axis.
Synclinal axis.
Bedding; tops indicated.
Geological contact.
Area of outcrop.
Pillow structure.
Trench.
Drill hole.
Quartz veins.
Pyrite.
SMC 14357

Mineralized Zones

A ZONE

Moorhouse (1938, p.23) stated that most of the production of the mine came from the A zone (A vein on Figure 16). It is located on surface about 6 m west of the shaft, and was described by Moorhouse as follows:

> The chief production of mine has come from "A" ore body, which is about 200 feet long [Figures 17, 18, 19]. At the surface, widths were about 3 feet. At the 624-foot level, the average width is 57 inches. At 720 feet and 925 feet, widths, determined by drilling, are 6.6 feet and 13.1 feet, respectively. Values above the thrust fault average 0.4 ounces in gold per ton; below it they averaged 0.16 ounces per ton. The deep drill-hole to 925 feet, however, gave an average value of 0.33 ounces per ton over a true width of 13.1 feet. The ore zone dips 70°N and in the upper levels rakes at 68°W. It has now been practically mined out above the 625-foot level. The above figures were supplied to the writer by Mr. Rukeyser[1].

Minor amounts of A zone ore types were found by Tindale (1967, p.7) in the back and pillars on the 30 m (100-foot) level. It was found on the 60 m (200-foot) and 99 m (325-foot) levels in small amounts. On the 145 m (475-foot) level and below, Tindale (1967, p.28) described the zone as follows:

> The A zone is weakly present on the 475 level. Some mining has been carried out at the west end above the level and a raise from the 625 breaks through in this area, perhaps indicating the mineable limit of the zone in this direction. The zone is visible in winze station but is narrow and very weak in sulphide mineralization. The zone consists of highly silicified greenstone with abundant quartz veining parallel to the foliation giving a banded or ribbony appearance with sparse disseminated pyrrhotite and chalcopyrite. A small dike-like body of silicified porphyry forms the hanging wall of the zone.
>
> On the 625 foot level the A zone is present as a pinching and swelling sheet of typical 'A' type with associated silicified type, enveloped with biotite wall rock alteration. The zone weakens to the east, sulphide content drops in proportion (to the weakening intensity of shearing) extending beyond the last chute and the zone ends in characteristic inter-fingering shear pattern in altered greenstone.
>
> Diamond drilling by Tashota Goldfields in 1938 and by Tashota Nipigon in 1967 picked up values in the 'A' zone below the 625 level. These, however, were of a low tenor in the 0.10 oz per ton range. Attempts to pick up the easterly extension of the zone to the east were unsuccessful, partly due to a poor drilling angle.
>
> In longitudinal section the 'A' zone has an hour-glass like outline, the narrow part characterized by 'A' type mineralization and veins are banded silicic-quartz types with low sulphides.

B ZONE

This zone is located 43 m south of the A zone (see Figure 17, Chart A, back pocket) and has no surface expression. It was developed on the 60 km (200-foot) level over a lateral distance of 41 m. Mineralization included material similar to the A zone, quartz veins with sulphide mineralization and massive pyrrhotite veins. The zone continues down to the 191 m (625-foot) level where it was exposed over a length of 30 m (Tindale 1967, p.9).

[1]Mine geologist at the time of Moorhouse's visit.

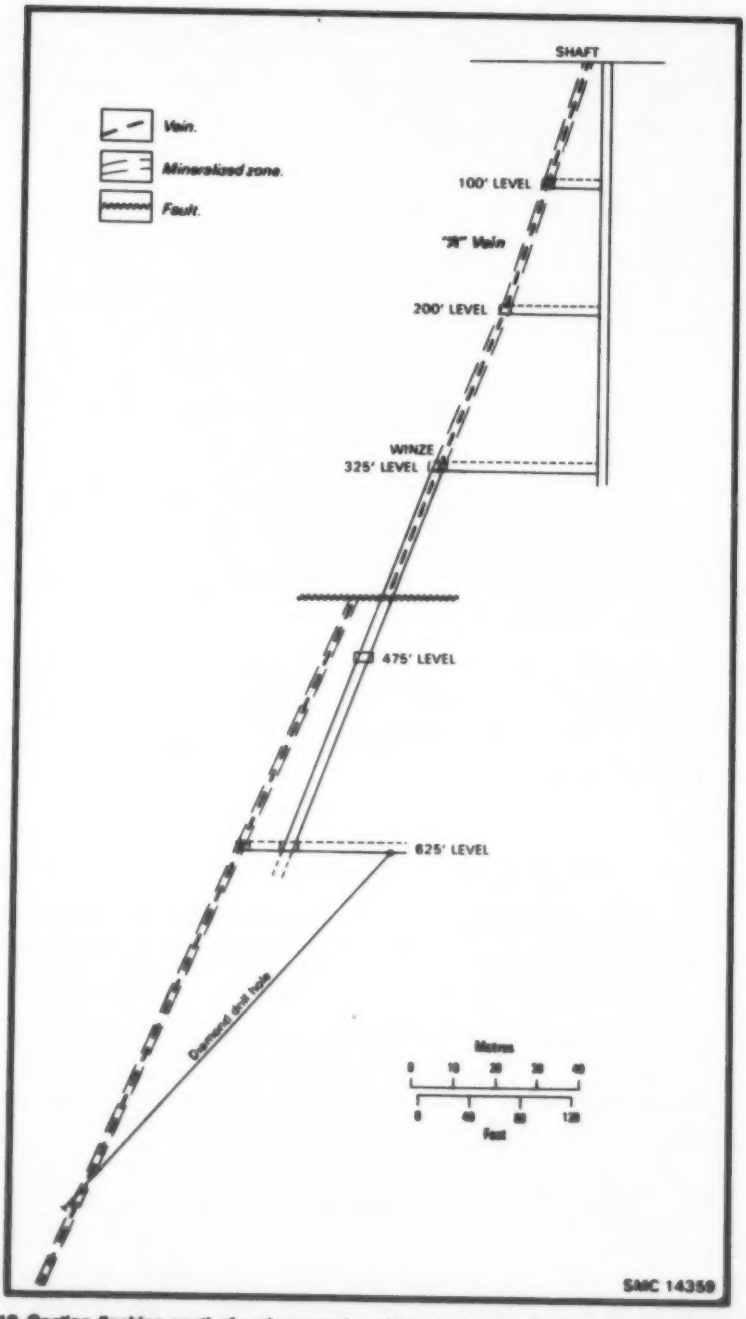


Figure 18–Section (looking east) of underground workings and veins, Tashota-Nipigon Mines Limited. From company plans.

C ZONE

The C zone's surface outcrop, the C vein on Figure 16, lies 60 m south of the main shaft, and is entirely hidden by tailings. Tindale indicated "low" assays but no further details.

D ZONE

The D zone is projected to surface in the vicinity of the inclined raise. It was thought by Moorhouse to represent the faulted extension of the A zone. Tindale (1967) indicated that lenses of A type mineralization occur on the main west drift on the 60 m (200-foot) level over an unspecified length. Moorhouse (1938, p.23) indicated the zone to be 35 m long, with an average width of 1.8 m. The zone has been mined out to surface. At the 191 m (625-foot) level it is exposed over a length of 45 m over an unspecified width.

E ZONE

Tindale (1967, p.9) described this zone as follows:

> In the No.1 East Drift, on the 200 level, irregular branching pods of mineralization occur in greenstones near a contact with relatively unaltered porphyry [Figure 17]. The localizing structure is probably a fold nose. Most of the mineralisation is the 'A' type with quite high sulphide content and associated breccia lenses containing disseminated sulphides.
>
> Fair values over narrow width were encountered in this zone on the 200 level. This does not appear to have any depth extension.

G ZONE

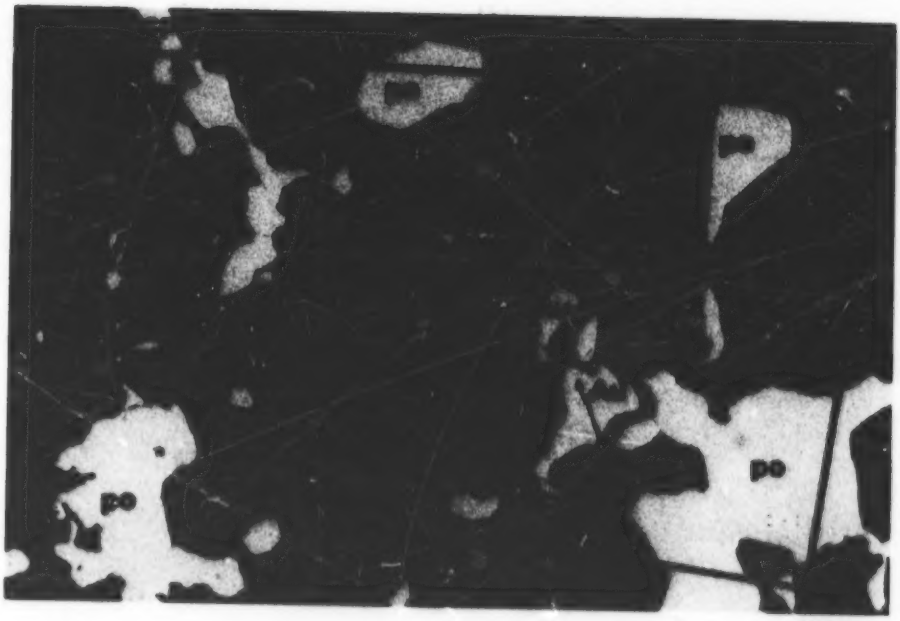
This zone occurs at the west end of the 60 m (200-foot) level where a series of lenses of quartz and quartz with pyrrhotite occur over a total length of 45 m.

Reserves

Tindale (1967, p.10) concluded that a total of about 3600 tonnes grading 0.20 ounce per ton Au could be salvaged from existing workings.

Mineralogy

Presumed A type mineralization was taken from the dump by the author and examined by W.D. Hicks of the Geoscience Laboratories, Ontario Geologi-



OGS 10 199

Photo 4–Photomicrograph (90x) of polished section of mineralization from Teshota-Nipigon Mines Limited. Blebs of gold interstitial to pyrrhotite in a quartz vein of the "A" zone. Most of the dark grey material is quartz; the brighter areas are mixed sulphides and gold. Photo by W.D. Hicks, Geoscience Laboratories, Ontario Geological Survey.

cal Survey. His description of the mineralization is as follows:

Quartz veinlets which contain the gold and sulphides are in parallel alignment.

The quantity of sulphides present depends upon the quantity of quartz. Where the quartz seams are wide, corresponding large amounts of pyrrhotite and chalcopyrite are found. Where quartz occurs as small lenticular seams, pyrrhotite, without chalcopyrite is found as small disseminated grains.

All the gold observed in hand specimen and in polished section is found in quartz. The grain size is fine, ranging from 0.01 to 0.1 mm. Although a few minute grains of gold are found entirely surrounded by quartz, most of the gold is in physical contact with pyrrhotite. It is of interest to note that the gold is at the outer edge of pyrrhotite grains and that the contacts are along straight lines, which in places show a hexagonal outline [see Photos 4, 5 and 6].

The position of the gold in relation to its surroundings suggest that it is a late stage mineral occupying minute fissures in the quartz and interstices between quartz and pyrrhotite.

Small grains of bismuth were noted in polished section (confirmed by X-ray diffraction methods). They occur in quartz and within the sulphides. Bismuth is thought to be part of an earlier stage of mineralization.

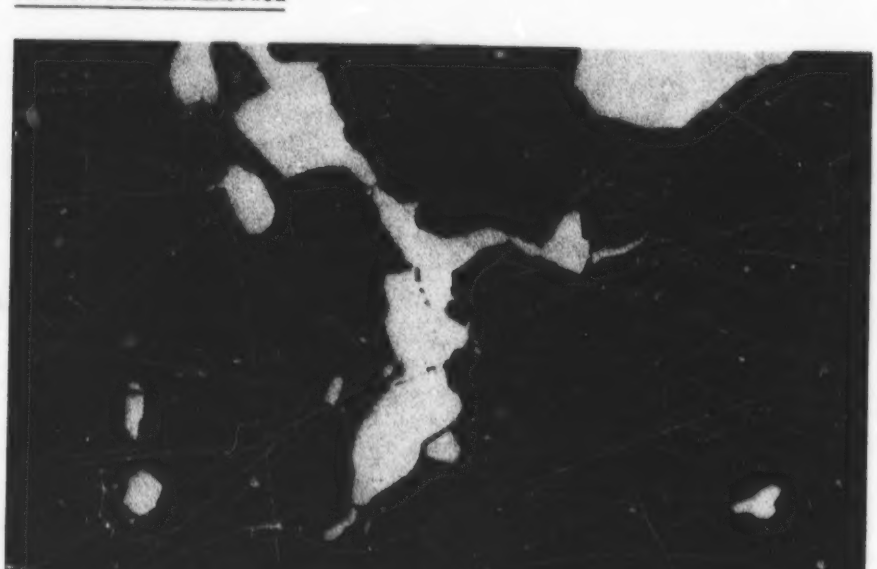


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Photo 5–Photomicrograph (180x) of a portion of the polished section in Photo 4. At this magnification the gold can be seen at the edge of most pyrrhotite grains and, more rarely, in fractures in the quartz. Photo by W.D. Hicks.

Mine Dump

The only material from the mine workings available to the writer was the mine dump. Rock types present included mafic metavolcanics, quartz and quartz-feldspar porphyry, and intensely altered chlorite and chlorite-biotite schist derived from mafic volcanic rocks, cut by quartz, and quartz-carbonate veins with disseminated pyrrhotite and chalcopyrite. Assays of samples collected by the writer are given in Table 11. Diorite from the dump when assayed, yielded low values as did representative mafic metavolcanics. It is apparent from Table 11, that the quartz vein material assumed to be of the A zone type carried most of the gold and base metal values.

West Showing

The so-called "west showing" at grid location 2300W, 175N (see Figure 16) was mapped by the author and found to consist of fine-grained sheared mafic metavolcanics in abrupt contact to the north with a brown weathering feldspar

Photo 6–Photomicrograph (180x) of a portion of the polished section in Photo 4. Photo by W.D. Hicks.

TABLE 11 ASSAYS OF SAMPLES FROM MINE DUMP, TASHOTA-NIPIGON MINES LIMITED. ALL ASSAYS BY GEOSCIENCE LABORATORIES, ONTARIO GEOLOGICAL SURVEY.

Sample	Au oz/ton	Ag oz/ton	Cu %	Pb %	Zn %	Bi %
1	0.11	tr	0.18			
2	3.42	2.98	0.81	-	-	0.08
3	0.38	0.46	0.32			
4	0.50	2.50	2.61			
5	0.36	tr	tr			
6	0.01	tr	tr			
7	0.01	tr	0.26			

- = not assayed for

Samples

1, 2, 3, 4. Quartz and quartz-carbonate vein material.
5. Brecciated feldspar porphyry with quartz-filled fractures up to 5 mm wide.
6. Diorite.
7. Mafic metavolcanics.

porphyry dike with 20 percent feldspar crystals and 5 percent lenticles up to 3 mm of biotite aggregates set in an aphanitic matrix. The dike is about 0.3 m wide. The mafic metavolcanics are often crumbly weathering and ankeritic where in contact with porphyry over widths of up to 0.3 m. North of the dike is 18-24 cm of brecciated oxide facies iron formation, composed of fragments up to 1 cm set in a greywacke matrix. The breccia is in turn succeeded to the north by another feldspar porphyry dike about 90 cm wide followed by a 9 m zone of carbonatized, sheared feldspar porphyry and finally 0.6-0.9 m of massive, rusty weathering sheared metagreywacke. All rock units strike N78W, dip 72 degrees nortl., and are exposed over a length of 42 m in a stripped area.

Assays ot grab samples taken by the author of the south and north feldspar porphyry bodies both returned 0.01 ounce per ton Au (assays by Geoscience Laboratories, Ontario Geological Survey).

Exploration Suggestions to Prospectors

The eastern extension of the A Zone should be investigated by diamond drilling, as the eastern limit has yet to be defined. The possibility of westward extensions of the G and H zones at depth and along strike has not been tested.

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PAGE

Amygdules 6
Analyses 11
  Chemical 12
Andesine 28
Assays . . . 36,39,42,43,45,46,52,54,61,66, 68,70,71
  Tables 51,56,59

Barn Lake 4,21,22,25,26
Barnum, R. 49
Basalts 3,6,14,16,26,27
  Magnesian 7,8
  Metamorphosed 4
  Pillowed 5
  Tholeiitic 4
Base metal showings 49
Bismuth 69
Breccia 63,71
Brennan, Gregory 38
Buffalo Red Lake Mines Ltd. 38

Canadian Mines Syndicate 33,34,45
Canadian Reynolds Metals Co. Ltd. 55
Carnduson Mines Ltd. 39
Chalcopyrite . . 34,36,45,48,53,55,59,69,70
Chert 6,20
Chloritoid 10
Chubb-Stuart syndicate 39
Cobalt 50,51
Contacts:
  Mafic metavolcanics-felsic metavolcanics 41
  Metavolcanic-granite 28,33,48
Conway and Stokes, Messrs. 49
Copper 37,51,59
  Assays 45,46,54
Copper-gold mineralization 38
Coughlan Lake 4,20,25,28,30
Coulee Lead and Zinc Mines Ltd. . . . . 34-49 *passim*, 53,61
Coutts, R.A. 61
Cox, N. 55
Cranston, William 48
Currie, Tom 38,54
Currie claim 54
Currie occurrence 34
Currie prospect 33

Dejour Mines Ltd. 55
Deposits, copper 37
Diamond drilling . . . 34,36,39,42,46,50-53 *passim*, 61,71
  Holes . 20,38,42,45,50-51 *passim* 55,61
  Results; tables 48,54
Dikes 29
  Aplite 26
  Diabase 4,28
  Feldspar porphyry 34,71
  Pegmatitic 26
  Porphyry 62,63

PAGE

Electrum 34
Epidote 6,10,21,23,28
Esker 29

Facies:
  Greenschist 21
  Hornblende hornfels 21
Faults 30,32,33,53
Feldspar 4,25
Felsic metavolcanics 9,10,14,22,36, 39,44,50
Felsic metavolcanics-mafic metavolcanics contact 41
Felsic unit, MacDonald Lake-Onaman Lake 11
Ferruginous chert 20
Flows 5,7,8,9,32,38,55,56,59
  Mafic 4
  Pillowed 4
  Rhyolitic 3
Folds 20,32,34,63
  Axes 30

Gabbro 22,63
  Sill 4
  Stock 4
Galena . . . . . 34-45 *passim*, 50,53,54,60
Garnet 6,21
Geraboy prospecting syndicate 49
Glacial Lake Nakina 29
Glacial striae 29
Gneiss 23
Gold 33,34,38,51,53,59,69,
  Assays 42,43,45,46,52,66,68
Gold-copper mineralization 38
Granite-metavolcanic contact . . . 28,33,48
Granodiorite 26
Greenschist facies 21
Grey, O. 49
Greywacke 22,27
Gulf Lead Mines Ltd. 54

Headvue Mines Ltd. 34,50
Headway property 36
Headway Red Lake Gold Mines Ltd. . . . . 36,46-55 *passim*
Hopkins, P.E. 49,54,55
Hornblende 4,6,7,22,23
  Hornfels facies 21

International Mine Services Ltd. 62
Intrusive relationships 23
Iron formation 4,20,21,30,32,33,36, 37,38,41,54,59,62,63,71
Iron oxides . . . . . 6-11 *passim*

Jenkins Lake 22,29
Johnson, T. 49
Johnson occurrence 34
Johnson prospect 33

PAGE

Joints 30,32

Kateri Mining Co. Ltd. 55

Lamprophyre sills 4
Lapilli 10
Lapilli-tuff 9,41
Lead 51
  Assays 42,43,45,46,52,54
Lee, Mr. 61
Lineaments 30,33
Lithologic units, table 5
Lynx-Canada *et al.* option 33,37
Lynx-Canada *et al.* sulphide deposit . . . 36
Lynx-Canada Expl. Ltd. 55

MacDonald Creek 55,56
MacDonald Lake . . 3-9 *passim*, 20,22,23,, 29,30,32,36,50,52
MacDonald Lake-Onaman Lake felsic unit. 11
McDonough, Ivan 60
McIntyre Porcupine Mines Ltd. 39,46
McKechnie, J. 33,61
McKechnie prospect. 33
McPhar Geophysics Ltd. 49
Mafic metavolcanics. . . . 4,6,8,10,20,22,25, 26,34,39-44 *passim*, 48,49,53,54,55,60-63 *passim*, 70-71
Mafic metavolcanics-felsic metavolcanics, contact 41
Magnesium. 14
Magnetite. 6,20,21,23,26,28
"Marathon" diabase dike swarm. 29
See also: Dikes.
Metavolcanic belt 24,25,26,32
Metavolcanic flows 7
Metavolcanic-granite contact 28,23,48
Metavolcanic lens 4
Metavolcanic-metasedimentary belt. 4,30
Metavolcanics 11,30
  Basaltic 3
  Dacitic 11
  Felsic 9,10,14,22,26,28,44,50
  Mafic . . . . . 4,6,8,10,20,22,25,26,34, 39-44 *passim*, 48,49,53,54, 55,60-63, *passim*, 70,71
Metavolcanics contact 41
Metavolcanic sequence 3
Metasediments:
  Biotitic 6
  Slaty 4
Metcalfe Creek 28,29
Mineflinders Ltd. 34
Mineralization, copper-gold 38
Moore, J. 60

Nakina, Glacial Lake 29
Nipissing Mining Co. 22,61
Noranda Expl. Co. Ltd. 20,34,36,39,

PAGE

42-55 *passim*, 60,61
North Onaman River 25,26,28,29
See also: Onaman River.
Nowlan Lake 4,6,22,26

Obashkogan Lake 4
Oligoclase 26
Onaman Lake . . 3,4,14,16,23-32 *passim*, 61
Onaman Lake-MacDonald Lake felsic unit. 11
Onaman River. . . . 3,6,7,8,20,22,25,26,28, 29,33,48,52,53,61
See also: North Onaman River.
Orebodies, sulphide 36

Pauloski, William. 60
Pauloski Lake. 6,8,9,26,60
Pauloski shear. 8
Pillowed flows 4
See also: Flows.
Pillows 5,6,30
Plagioclase 6,7,10,11,22,23
Porphyry 3,9,45
  Dikes 62,63
  Sills 4
Pyrite . . . . . 6,34,36,39-50 *passim*, 53,60
  Vein 54
Pyroclastics 4,10
  Rocks 3,9
Pyroxene 28
Pyrrhotite 21,34,36,46,48,53,55,59, 61,68,69,70
  Veins 66

Quartz. . . . 6-11 *passim*, 21-28 *passim*, 39, 41,42,53,60,70
  Veinlets. 69
  Veins 26,34,37,38,42,43,44,45, 56,59,66
Quartz-carbonate veins. 36,70
Quartz-feldspar porphyry 3
Quartz monzonite 4
Questor Surveys Ltd. 53

Red Lake Gold Mines Ltd. 34
Rhyolite 9,11
Rhyolitic flows. 3
Rouyndah Oils and Metals Ltd. 61

Sand 29
Schist 4,8,9,10,42,43,45,53,62,63,70
Shearing 50,53
Shear zones 36,39,60,63
Silts 4,22,25
Silver 34,50,51,53,59
  Assays. 36,39,42,43,45,46,52,54
  See also: Assays.
Sphalerite 36,38,39,54
Spheno 6,21,22,28
Stilpnomelane. 21
Striae, glacial 29

PAGE
"Sudbury" diabase dike swarm 29
Sulphide minerals 39
See also: Chalcopyrite; Galena; Pyrite; Pyrrhotite; Sphalerite.
Sulphides 36,55,59,68,69
Blebs 34
Orebodies 36
Surveys:
Dip needle 38
Electromagnetic 34,48,49,53,55
Geochemical 48,53
Geological 48,55
Geophysical 48,53
Ground magnetic 48
Induced polarization 39,51
Magnetometer 49,61

Tashota (station) 61
Tashota Goldfields Ltd. 34
Mine production, table 62
Tashota Gold Mines Ltd. 33,61
Tashota mine 4,6,7,10,20,21,22,30, 33,34,37,38,59,61
Tashota mine road 21,29,56

PAGE
Tashota Nipigon Mines Ltd. 20,32,49, 54,55,61,62
Thorsteinson, D. 55
Trenching 33
Trondhjemite 4
Tuff 6,9,10,11,36,42,44,50,55
Tuff-breccia 8,9,41

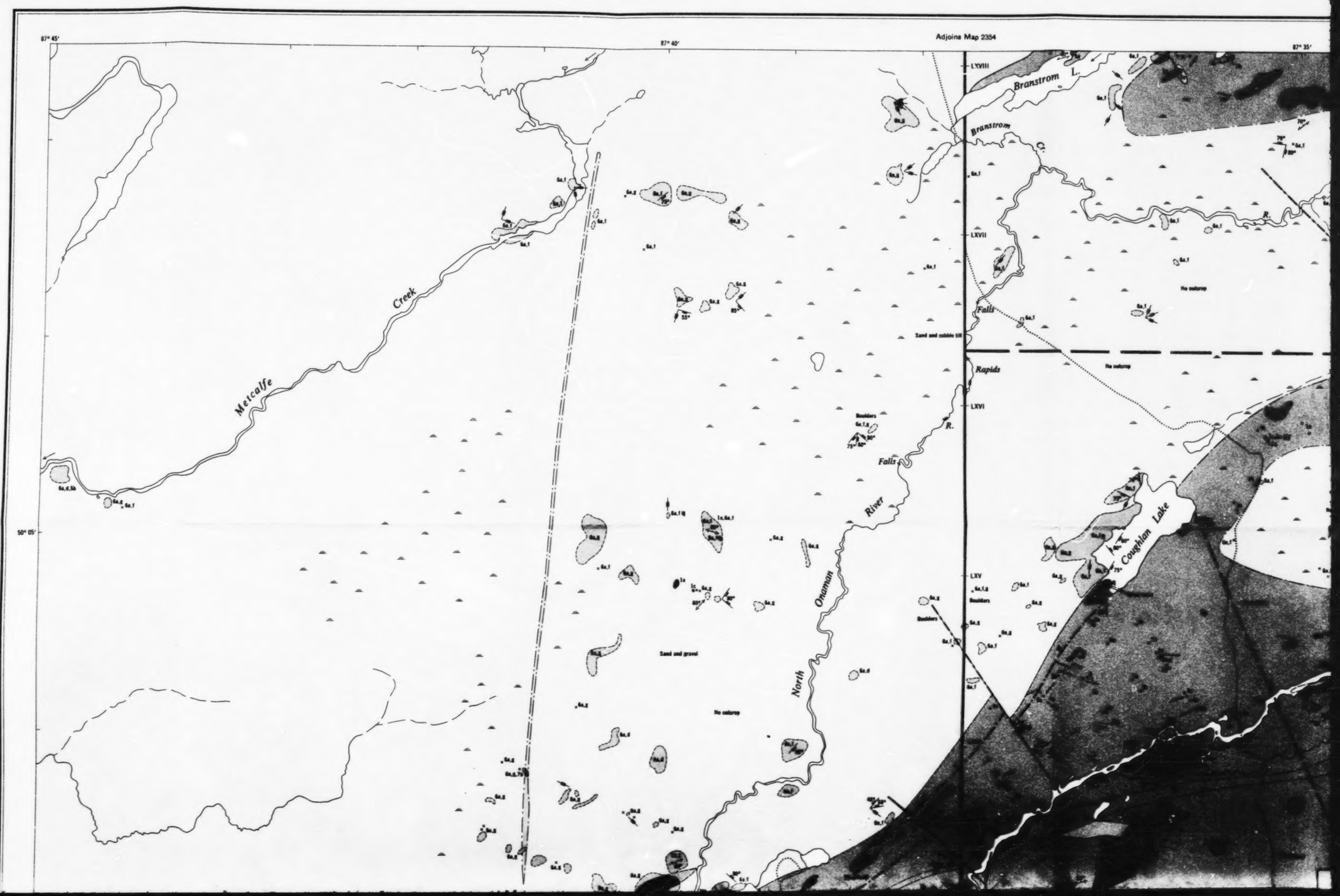
Varved clays 29
Veinlets, quartz 69
Veins 22,38,39,41,42,46,52
Pyrite 54
Pyrrhotite 54
Quartz 26,34,37,44,45,56,59,66
Gold-bearing 38
Quartz-carbonate 36,69
Vein systems 33

Xenoliths 25

Zinc 34,51
Assays 42,43,45,46,52,54
See also: Assays.

SYMBOLS

- Glacial striae.
- Esker.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top indicated by arrow; (inclined, vertical, overturned).
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
- Lava flow; top (arrow) from pillows shape and packing.
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity, (horizontal, inclined, vertical).
- Foliation; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Geological boundary, deduced from geophysics.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Lineament.
- Jointing; (horizontal, inclined, vertical).
- Drag folds with plunge.
- Anticline, syncline, with plunge.
- Drill hole; (vertical, inclined).
- Vein.
- MA — Magnetic attraction.
- Muskeg or swamp.
- Motor road.
- Trail, portage, winter road.
- Building.
- 48 — Base or meridian line, with milepost.
- Township boundary, unsurveyed.
- Mining property, surveyed.
- (11) — Mineral deposit; mining property, unsurveyed.

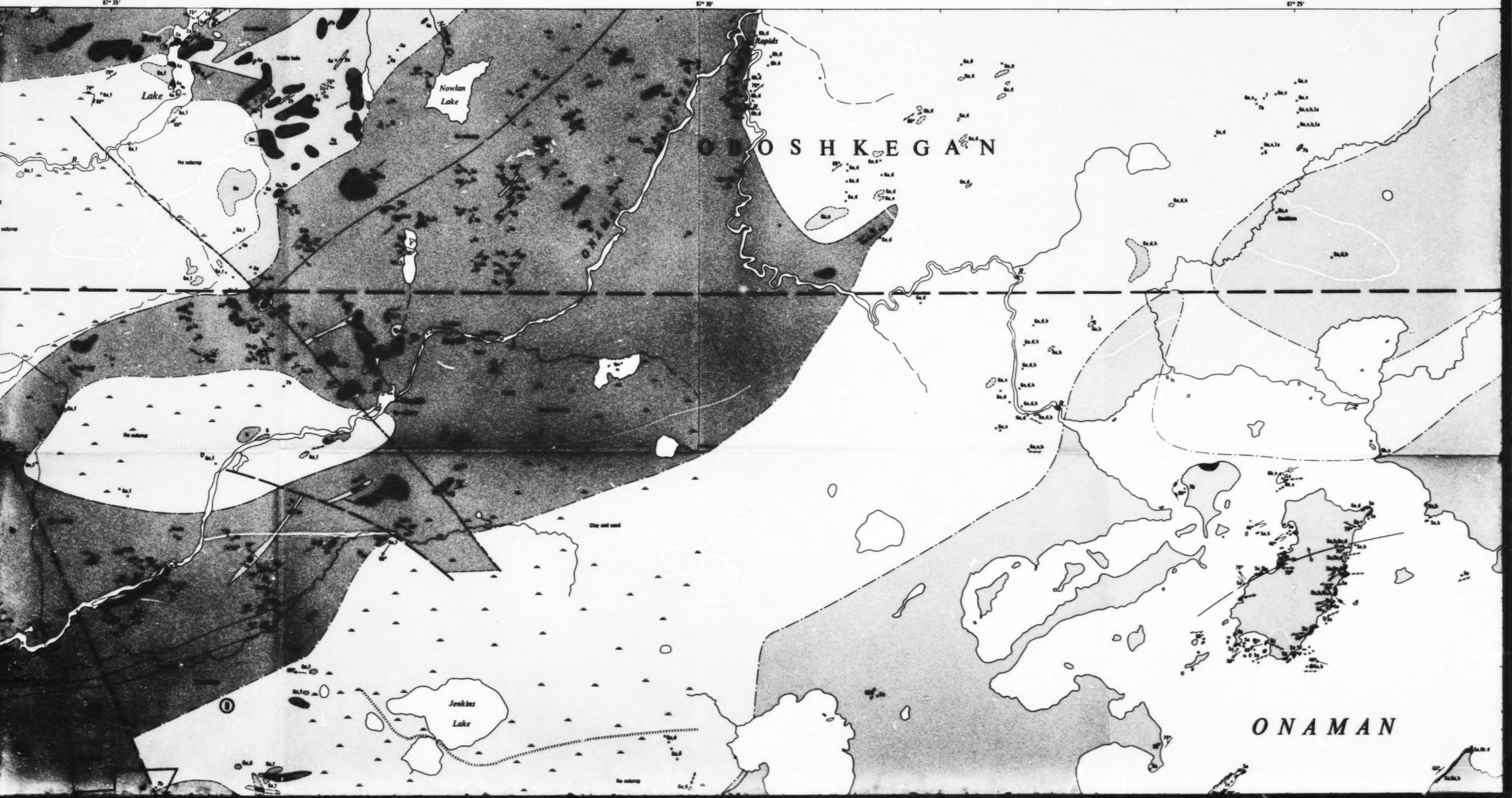


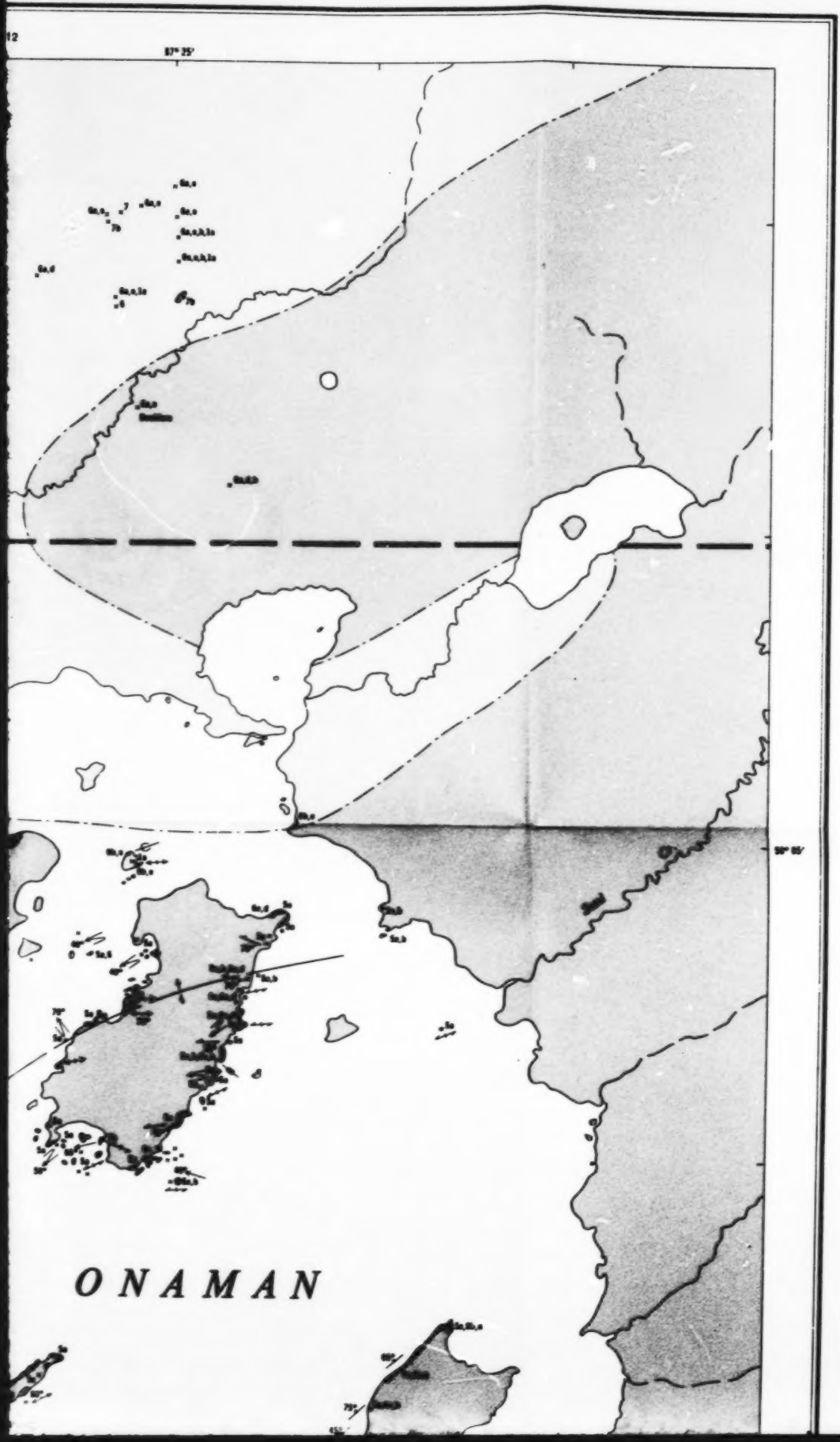
Ontario

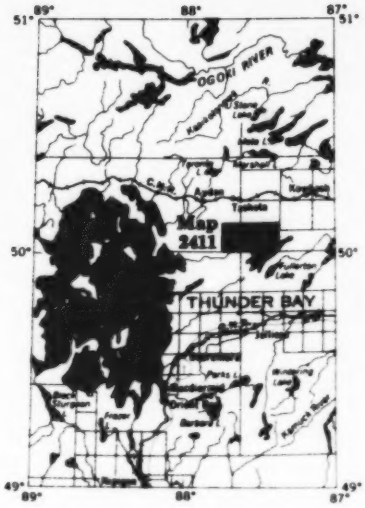
Ministry of Natural Resources

Hon. James A. C. Auld
Minister

Dr. J. K. Reynolds
Deputy Minister







Scale 1 inch to 50 miles
N.T.S. reference 42 L/3, 42 L/4

LEGEND

PHANEROZOIC

CENOZOIC[a]

QUATERNARY

PLEISTOCENE AND RECENT

Till, clay, sand, and gravel.

UNCONFORMITY

PRECAMBRIAN[b]

MIDDLE AND LATE PRECAMBRIAN (PROTEROZOIC)

MAFIC INTRUSIVE ROCKS

7 Unsubdivided.
7a Porphyritic diabase.
7b Massive diabase.

INTRUSIVE CONTACT

EARLY PRECAMBRIAN (ARCHEAN)[c]

FELSIC IGNEOUS AND METAMORPHIC ROCKS

FELSIC INTRUSIVE ROCKS

6 Unsubdivided.
6a Massive.
6b Foliated.
6c Porphyritic.
6d Biotite, biotite-hornblende trondhjemite, granodiorite.
6e Hornblende, hornblende-biotite trondhjemite, granodiorite.
6f Hornblende, hornblende-biotite quartz monzonite.
6g Biotite, biotite-hornblende quartz monzonite.
6h Pegmatite, aplite.
6j Quartz-feldspar porphyry.

INTRUSIVE OR GRADATIONAL CONTACT

MIGMATITIC ROCKS

5 Unsubdivided.
5a Metasedimentary migmatite (biotite-quartz-feldspar schist and gneiss) > 10% granitic material.
5b Metavolcanic migmatite (hornblende-feldspar schist and gneiss) > 10% granitic material.

METAMORPHOSED MAFIC INTRUSIVE ROCKS

4a Gabbro.[d]
4b Diorite.

INTRUSIVE CONTACT

METAVOLCANICS AND

8 — *Mining property, surveyed.*

⑪ — *Mineral deposit; mining property, unsurveyed.*

Surveyed line, approximate position only.

PROPERTIES, MINERAL DEPOSITS

1. *Buffalo Red Lake Mines Ltd. [1952]*
2. *Coulee Lead and Zinc Mines Ltd.*
3. *Cranston, W. [1949]*
4. *Elite Cobalt Mines Ltd. [1967]*
5. *Geraboy Syndicate [1949]*
6. *Grey, O. [1949]*
7. *Headway Red Lake Gold Mines Ltd.*
8. *Hopkins, A. P.*
9. *Kateri Mining Co. Ltd. [1952]*
10. *Lynx-Canada Explorations Ltd., Dejour Mines Ltd., Canadian Reynolds Metals Co. Ltd.*
11. *McDonough, I. [1949]*
12. *Mosso, J. [1949]*
13. *Pauloski occurrence.*
14. *Rouandah occurrence.*
15. *Tashota-Nipigon Mines Ltd. (Tashota Goldfields mine).*

Information current to December 31st, 1972, except for property 10, which is current to December 31st, 1975.
Former properties on ground now open for staking are only shown if exploration data is available—a date in square brackets indicates last year of exploration activity. For further information see report.

SOURCES OF INFORMATION

Geology by P. C. Thurston and assistants, 1972. Additional geology and mineral occurrence information added in January 1976.
Geology is not tied to survey lines.

ODM-GSC Aeromagnetic maps 2137G Elbow Lake, and 2144G Suni Lake.

Preliminary maps P.846, North Onaman Area (Western Half), and P.847, North Onaman Area (Eastern Half), scale 1 inch to ¼ mile, issued 1973.

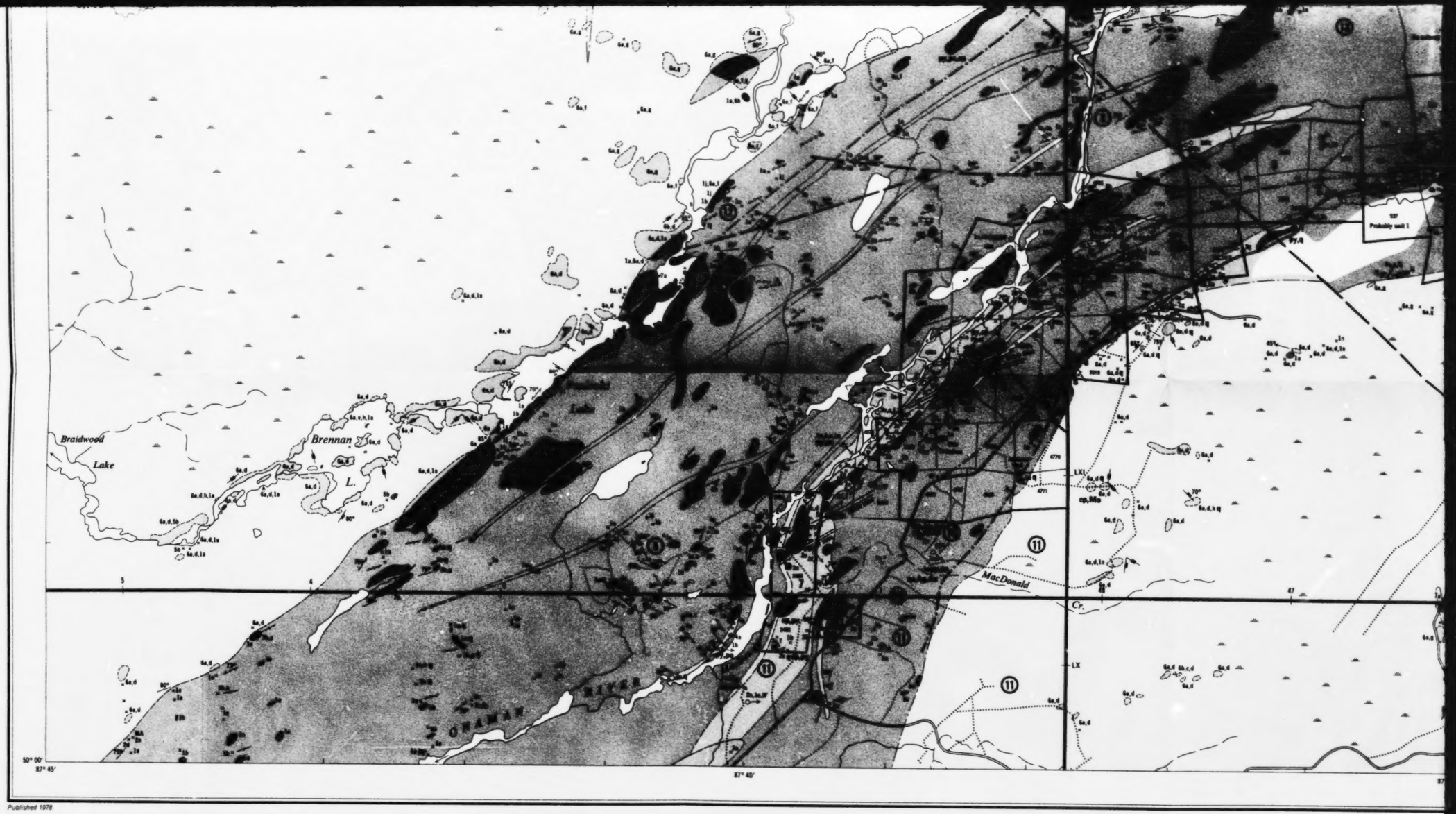
Cartography by M. J. Colman and assistants, Ministry of Natural Resources, 1977.

Basemap derived from maps of the Forest Resources Inventory, Ministry of Natural Resources, with corrections by P. C. Thurston.

Magnetic declination in the area was 2°W, 1975.

Parts of this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form:

Thurston, P.C.
1978: Onaman Lake; Ontario Geological Survey Map 2411, Precambrian Geology Series, scale 1 inch to ¼ mile. Geology 1976.



Published 1978

Ontario Geological Survey

Map 2411

ONAMAN LAKE

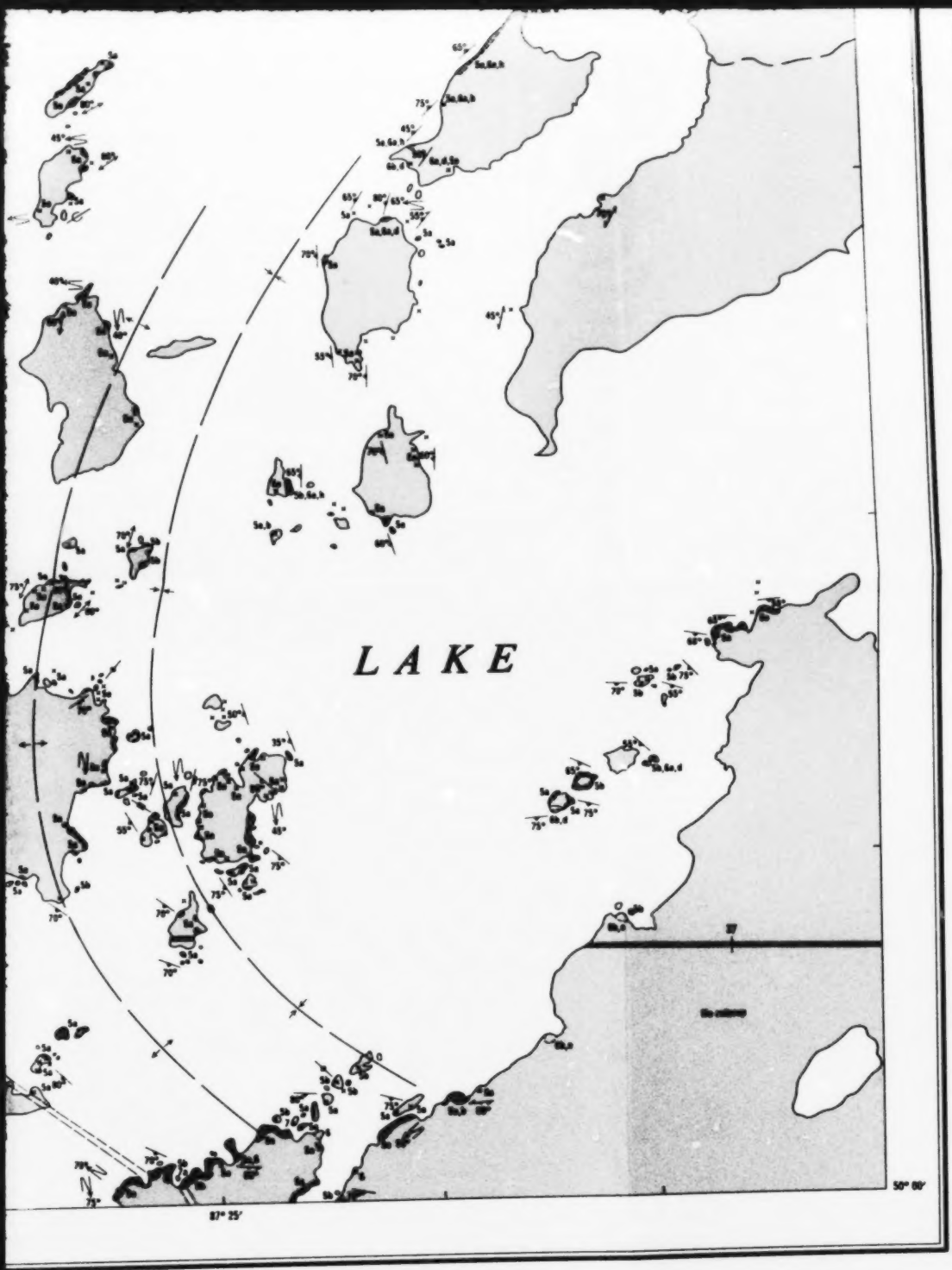
THUNDER BAY DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles

Metres 1000 0 1 2 3 Kilometres

Feet 1000 0 5,000 10,000 Feet



4a Gabbro.[d]
4b Diorite.

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS[a]

METASEDIMENTS

3a Conglomerate.

FELSIC METAVOLCANICS

2a Rhyolite to rhyodacite.
2b Rhyodacite.
2c Crystal and lapilli tuff.
2d Banded tuff.
2e Rhyolitic quartz porphyry.
2f Chloritoid sericite schist.
2g Quartz-feldspar porphyry.

MAFIC METAVOLCANICS

1 Unsubdivided basaltic rocks.
1a Massive to foliated flows.
1b Pillowed flows.
1c Porphyritic flows.
1d Chlorite schist.
1e Tuff.
1g Amygdular flows.
1h Lapillistone, tuff-breccia.
1j High magnesian basalt.

Iron formation.

Carbonatized rock.

Ag	Silver.
Au	Gold
cp	Chalcopyrite.
Cu	Copper.
gf	Graphite.
Mo	Molybdenum.
Pb	Lead.
po	Pyrrhotite.
py	Pyrite.
q	Quartz.
S	Sulphide mineralization.
Zn	Zinc.

[a] Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured and uncoloured parts of the map.

[b] Bedrock geology. Outcrops and inferred extensions of each rock map unit are shown respectively in deep and light tones of the same colour. Where in places a formation is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.

[c] Subdivision of major rock units does not indicate age relationships.

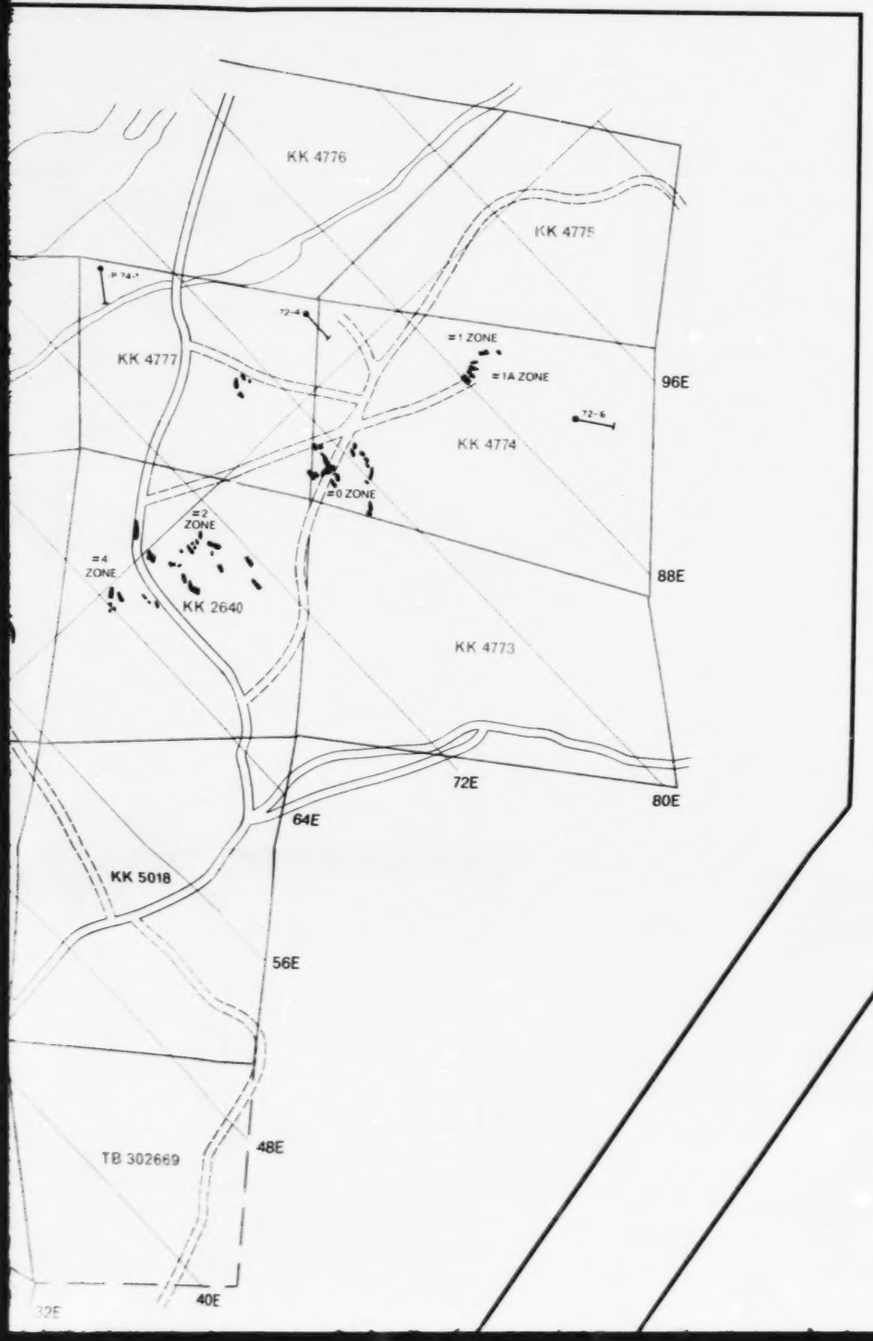
[d] May include some high magnesium basalt.

[e] Age relations between units 1, 2 and 3 are unknown.

NOTES

The designating letters "KK" have been omitted from the claims on this map.

KK 4776
KK 4775
KK 4981
KK 2809
KK 4777
KK 4774
KK 4978
KK 4977
KK 2810
KK 2640
KK 4773
TB 302668
KK 4724
KK 2190
KK 2189
KK 2811
KK 5018
TB 302667
COULEE CAMP
"FRIDAY VEIN" FLOAT
RIVER
KK 4979
KK 2192
KK 2191
KK 4727
KK 5570
TB 302669
TB 302665
TB 302666
KK 2193
≠1 ZONE
≠1A ZONE
≠0 ZONE
≠2 ZONE
≠4 ZONE
≠6 ZONE
≠5 ZONE
≠3 ZONE
≠18 Cu Zone
Trenched by Canada Mines Syndicate
72E
64E
56E
48E
40E
32E



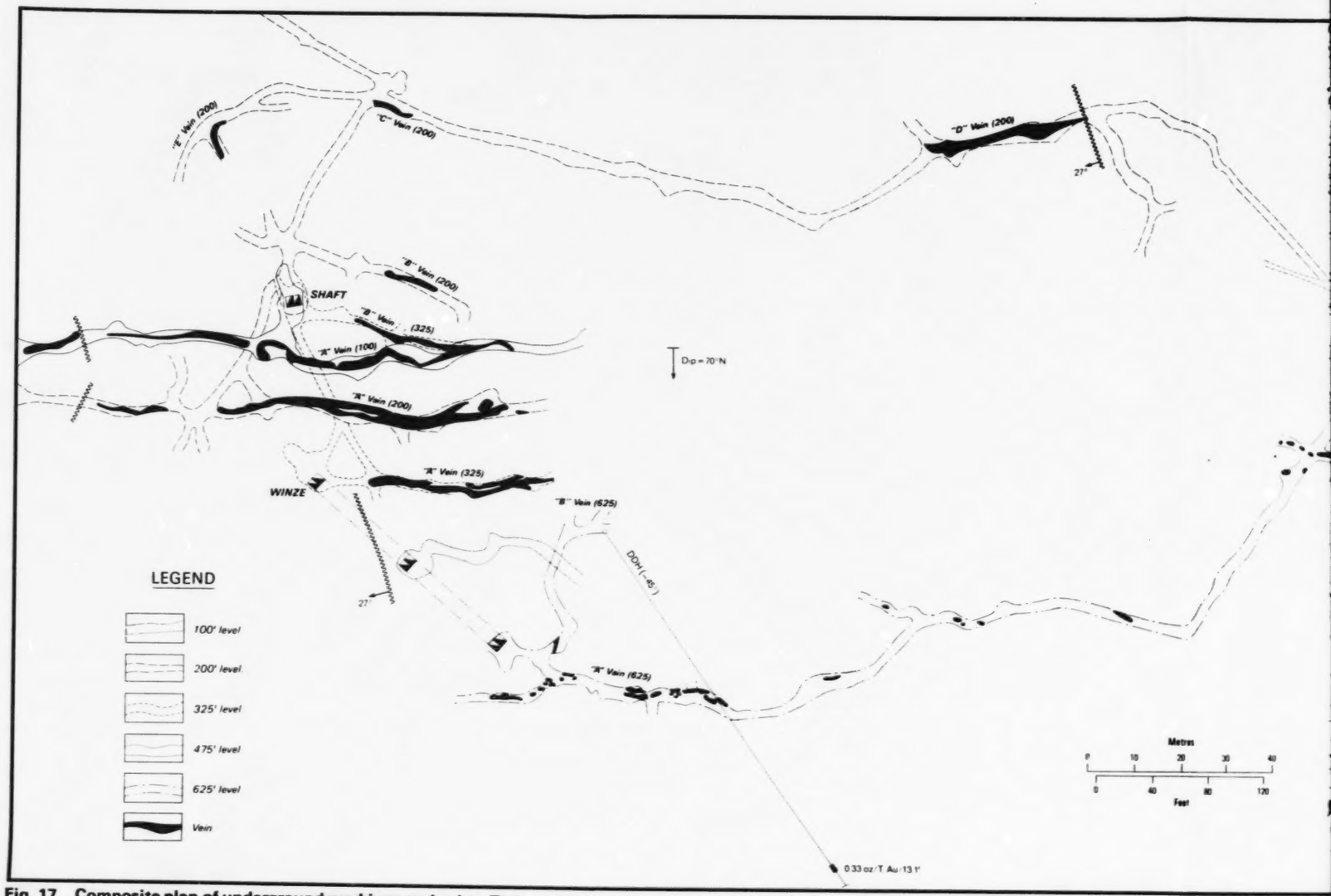
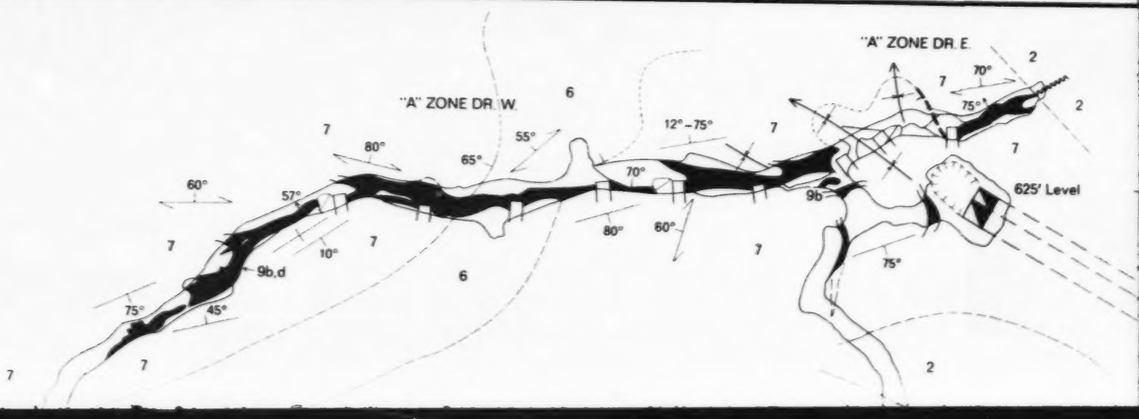
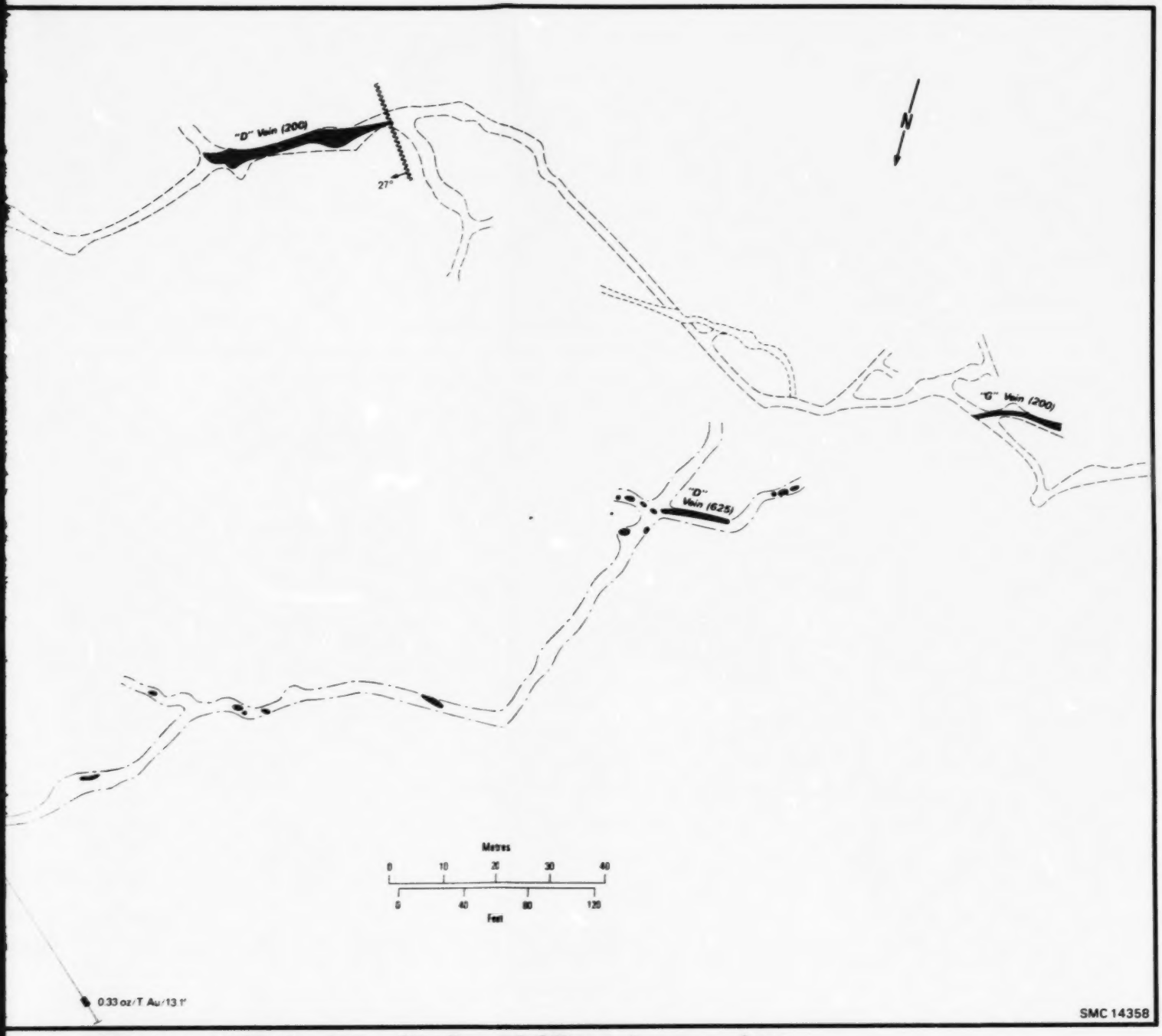
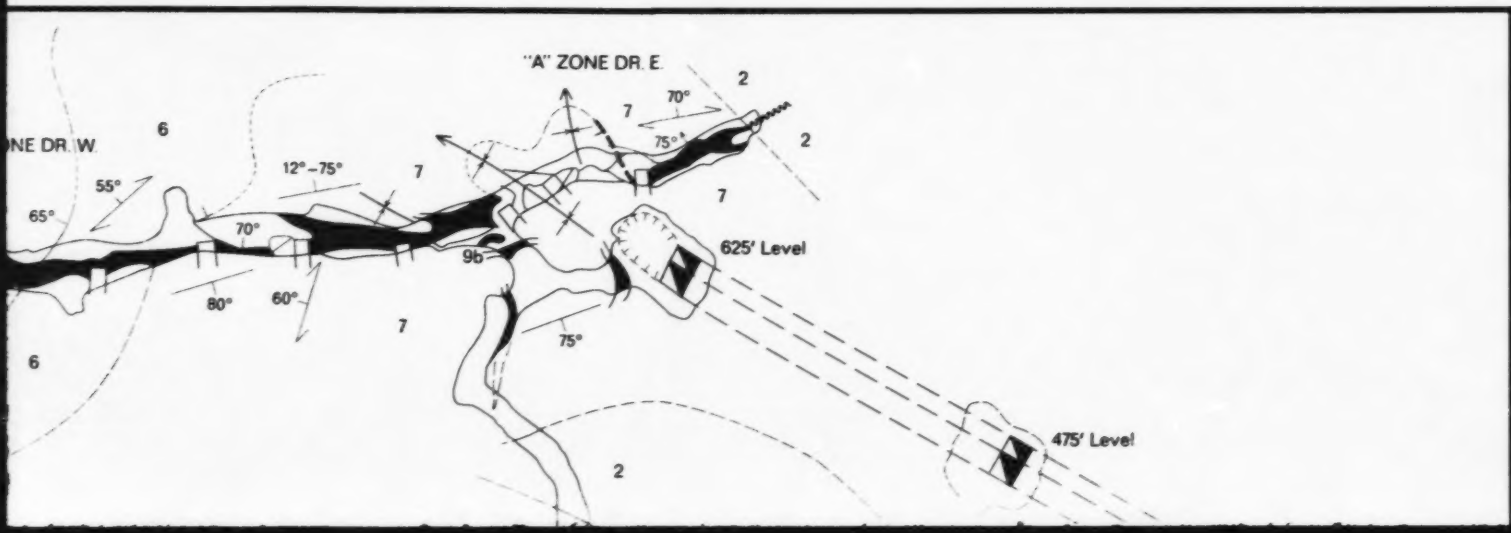


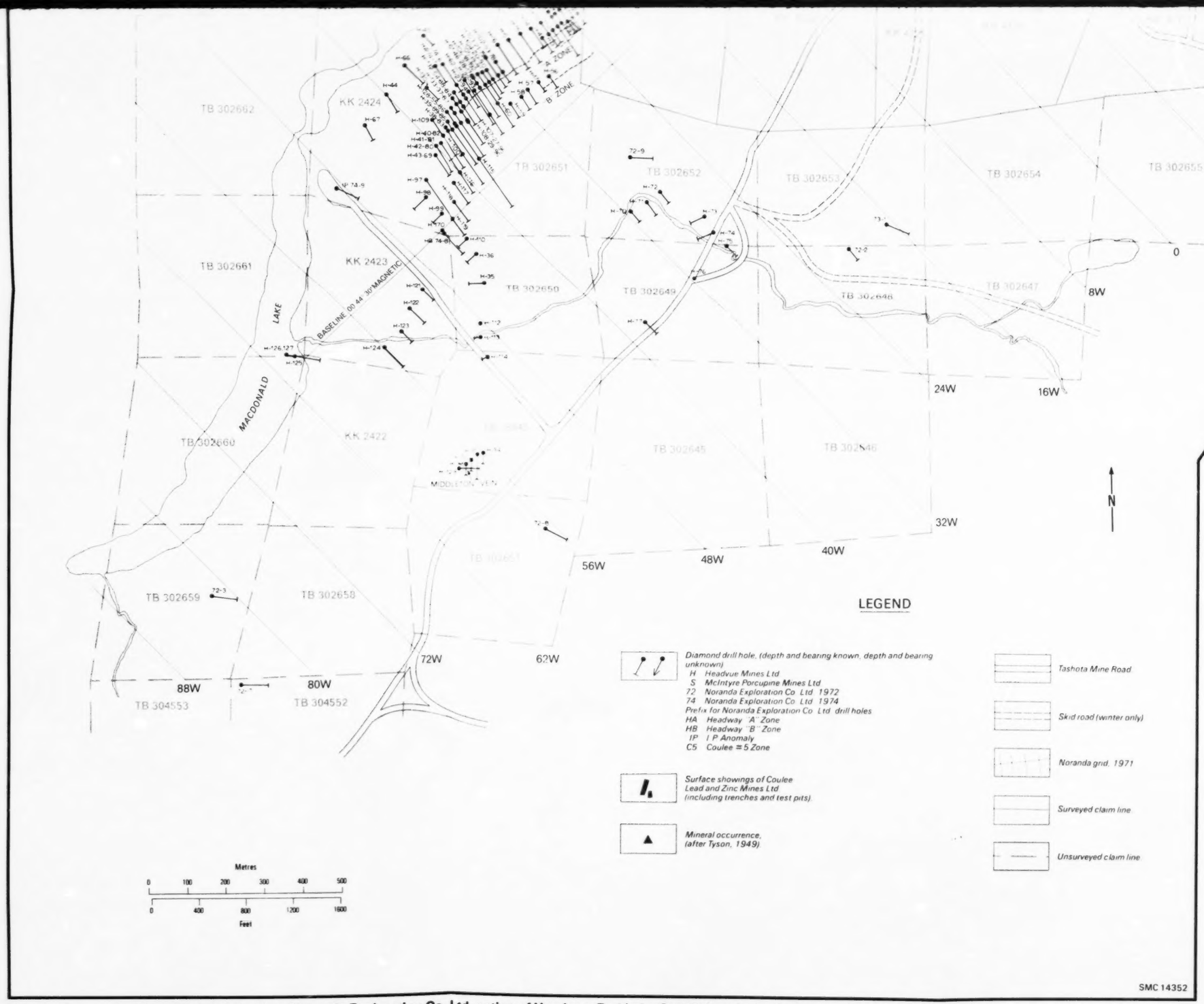
Fig. 17 Composite plan of underground workings and veins, Tashota-Ñipigon Mines Ltd. Information from Moorhouse (1938), Assessment Files Research Office, and co





ation from Moorhouse (1938), Assessment Files Research Office, and company plans.





LEGEND

Diamond drill hole, (depth and bearing known, depth and bearing unknown)
H Headvue Mines Ltd.
S McIntyre Porcupine Mines Ltd.
72 Noranda Exploration Co. Ltd. 1972
74 Noranda Exploration Co. Ltd. 1974
Prefix for Noranda Exploration Co. Ltd. drill holes
HA Headway "A" Zone
HB Headway "B" Zone
IP I.P. Anomaly
C5 Coulee #5 Zone

Surface showings of Coulee Lead and Zinc Mines Ltd. (including trenches and test pits).

Mineral occurrence, (after Tyson, 1949).

Tashota Mine Road

Skid road (winter only)

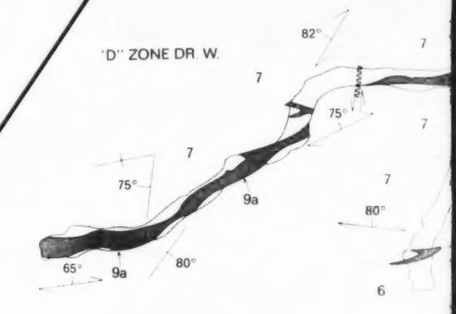
Noranda grid, 1971

Surveyed claim line

Unsurveyed claim line

SMC 14352

Fig. 11 Composite diamond drill hole plan, Noranda Exploration Co. Ltd. option of Headway Red Lake Gold Mines Ltd. – Coulee Lead and Zinc Mines Ltd. properties, 1971-1974. Also shown is earlier (1950's) drilling of McIntyre Porcupine Mines Ltd. and Headvue Mines Ltd. from maps by Noranda Exploration Co. Ltd.



LEGEND

9a Silicified chlorite / quartz biotite
9b Sheared greenstone gabbro
9c Brecciated quartz veins / pods
9d Highly altered silicified greenstone

7 Altered gabbro

6 Quartz-feldspar porphyry

2 Gabbro-diorite

55°–85° Attitude of schistosity and lineation.

75° Attitude of prominent joints

Dip of vein.

80° Dip of contact.

Shear or breccia zone.

Fault

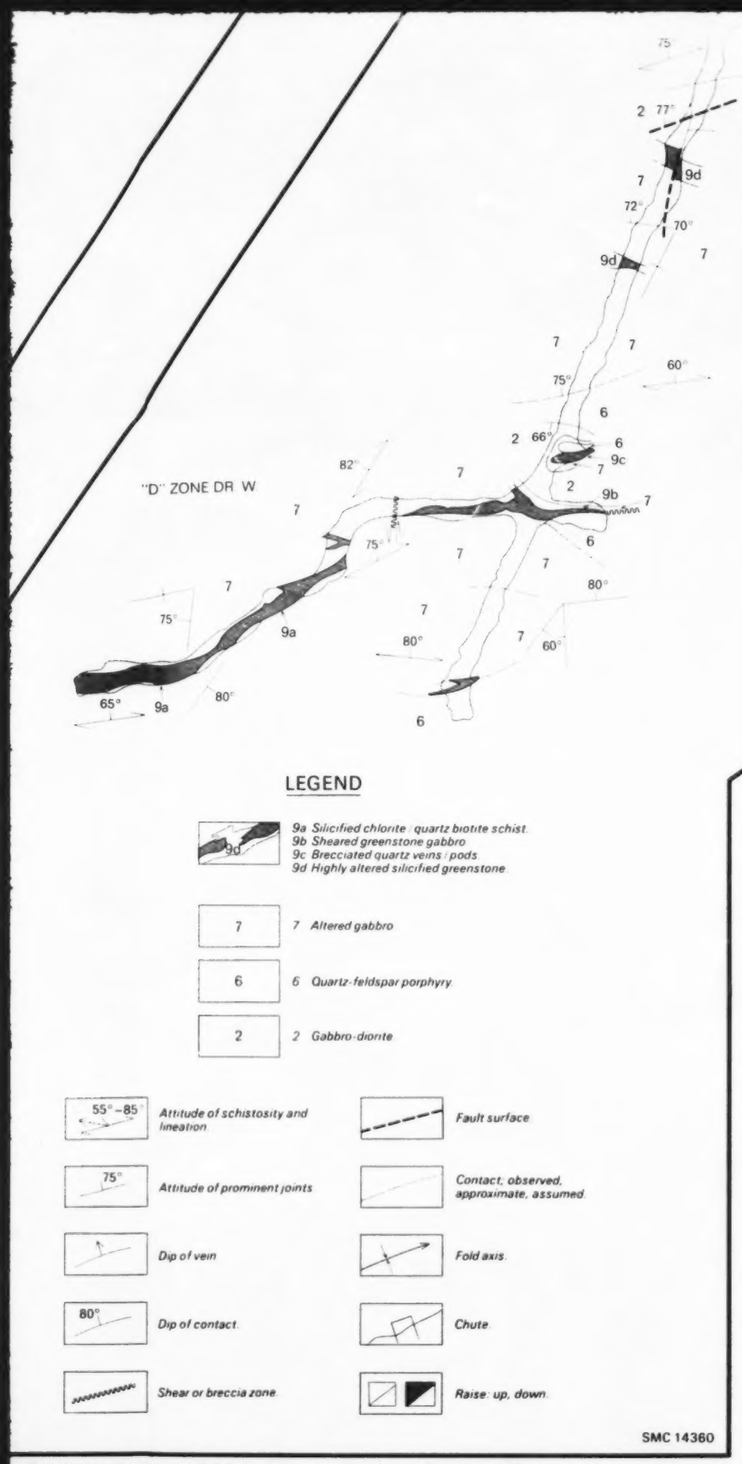
Contact approx.

Fold axis

Chute

Raise

Fig. 19 Geological plan of 625 foot Level, Tashota-Nipigon. From company plans, 1967.



Geological plan of 625 foot Level, Tashota-Nipigon Mines Ltd. mpany plans, 1967.

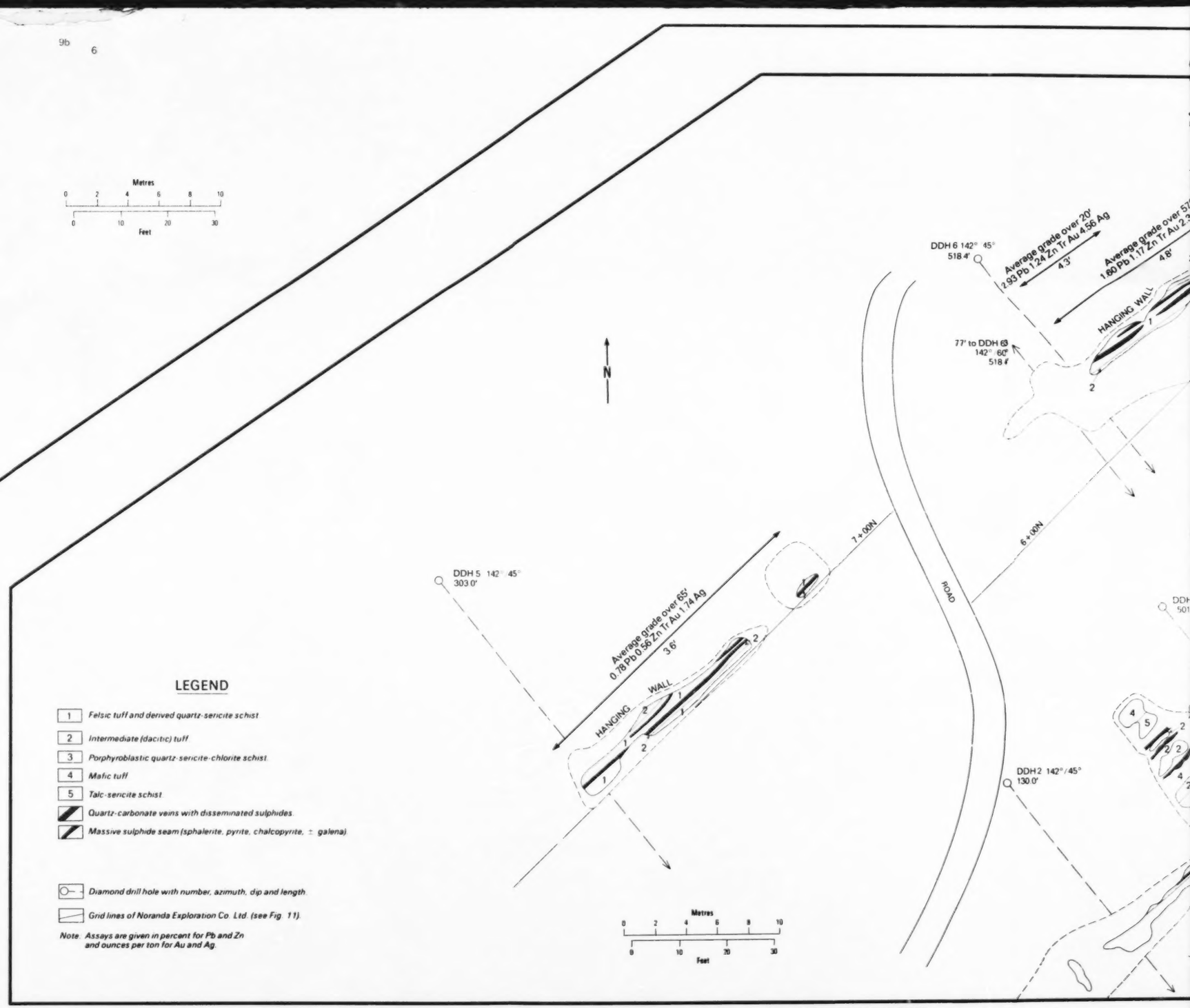
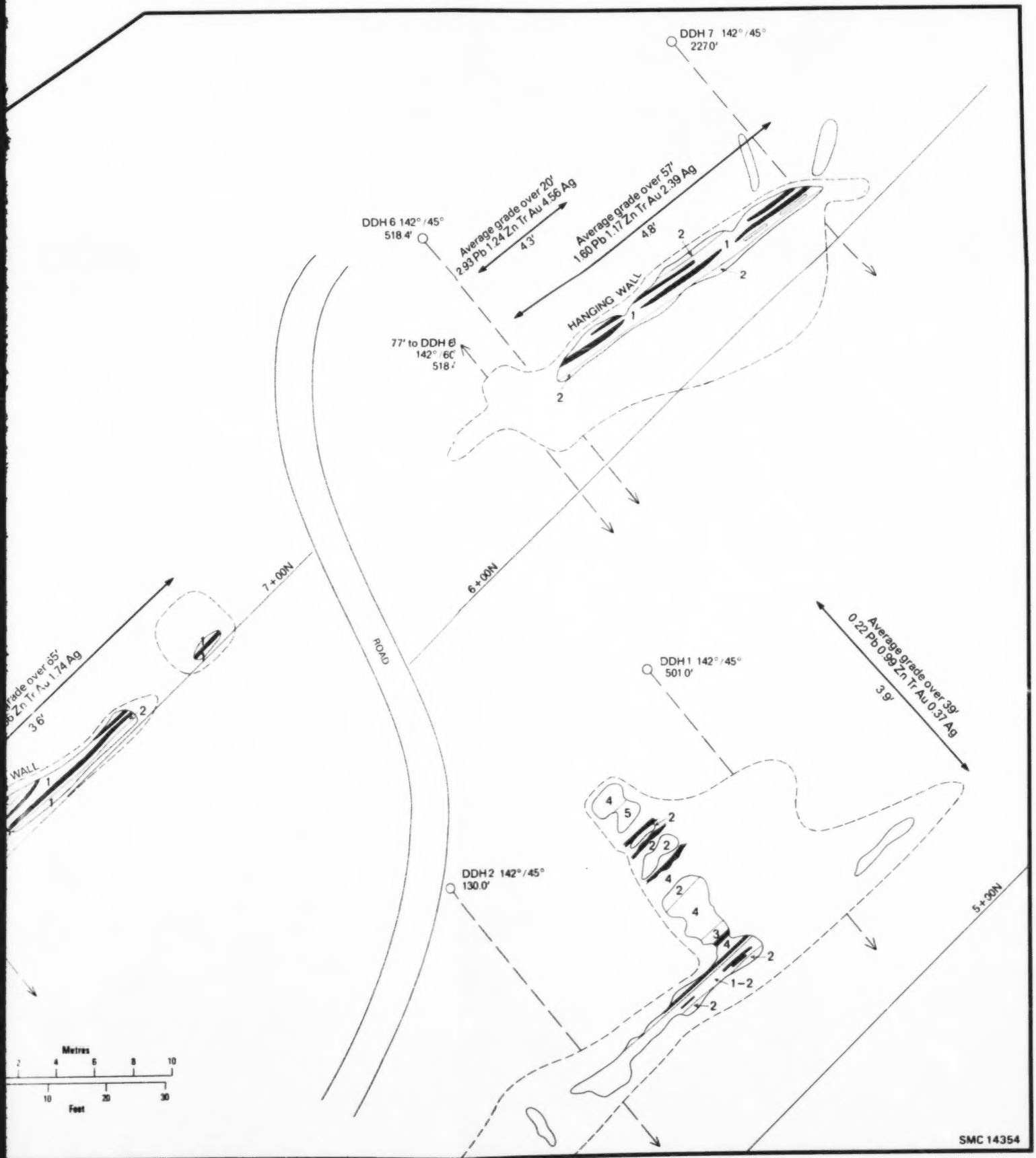


Fig. 13 Geology and assay plan, Headway Red Lake Gold Mines Ltd. "Main" Zone (Noranda Exploration Co. Ltd. option). After Moffat (1974).



oration Co. Ltd. option). After Moffat (1974).